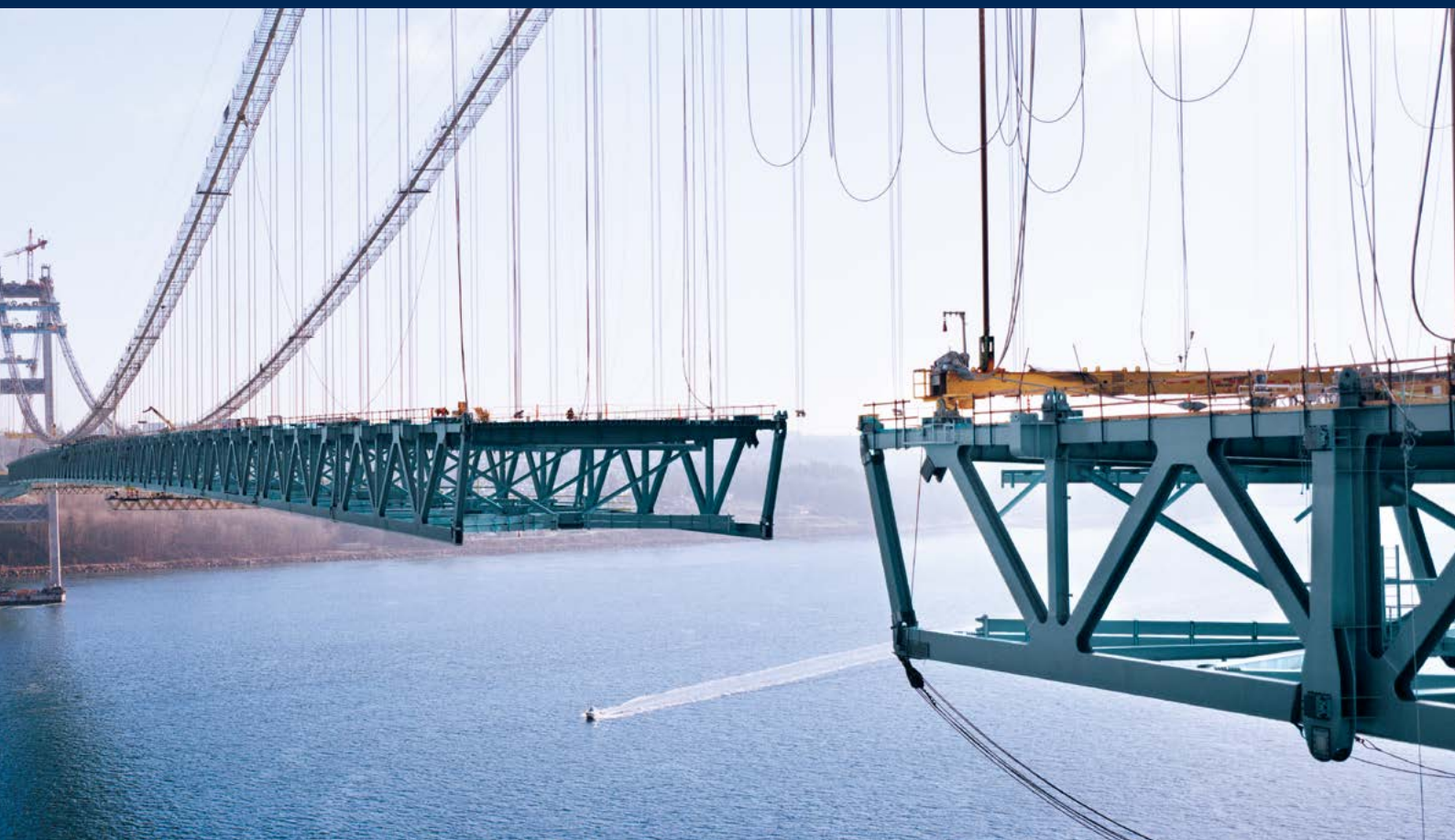
First Sensor

Industrial

Individual sensor solutions for the industrial sector

Our applications and products



First Sensor AG is one of the world‘s leading suppliers in the field of sensor systems. Our company develops and manufactures standardized and customized sensor solutions for applications in the industrial, medical and mobility growth markets.

Developing tomorrow’s products together today

First Sensor AG is one of the world‘s leading suppliers in the field of sensor systems. With over 800 employees, we are represented at six German locations and also have production and sales sites in the USA, Canada, China, Great Britain, France, Sweden, Denmark and the Netherlands along with a worldwide partner network. Together we identify, meet and solve the challenges of the future with our innovative sensor solutions early on.

„First Sensor is increasing its presence on its target markets through new smart sensors systems that react intelligently to the measurement results and communicate with other systems.“

Dr. Mathias Gollwitzer, Executive Board, First Sensor AG

In the growth market of sensor systems, First Sensor develops and produces customer-specific solutions for the ever-increasing number of applications in the industrial, medical, and mobility target markets. Based on tried-and-tested technology platforms, we develop products such as chips, components, sensors, and entire smart sensor systems. These products give you a real competitive edge. Trends such as Industry 4.0, autonomous driving, and the miniaturization of medical technology will drive our growth extremely rapidly in the future.

Using our detailed understanding of your specific application, we develop solutions whose capabilities go far beyond those of standard components already on the market. By focusing on technology-driven target markets, we are already playing a role in their exceptionally rapid growth. In the future, too, we will benefit from the megatrends that drive these markets. Our goal here is to identify and meet the challenges of the future early on – a goal that is firmly anchored in our corporate culture.

Among the customers of First Sensor are well-known industrial groups and young technology companies that utilize our know-how and many years of expertise to develop their own innovative products. They appreciate the opportunity to make individual adjustments at every stage of the value chain in order to create exceptionally powerful sensors and sensor systems with tailored features. This joint development work frequently forms the basis for long-standing partnerships.

Our expertise – Your success

We have developed into an integral, internationally oriented technological company over the past few years. Numerous long-standing customer relations with OEMs, system providers and device manufacturers vouch for our professionalism and expertise.

We can advise you what sensor is best suited to your application or whether a custom solution might even attain a better „total cost of ownership." We place great importance in understanding your application so that we can literally „talk the same language."

No matter whether specific quality criteria have to be complied with or new developments are to be integrated promptly and seamlessly in the existing technological environments. Our project management expertise ensures that all process steps are oriented to your needs – from development and production to quality testing and logistics.

Innovative products are frequently associated with high investments and quality standards. That makes long-term production and supply certainty all the more important. Our project team can therefore accompany you through the entire process while offering advice on all levels.

You will already find the right solution to many applications in our wide and field-tested range of high-performance product platforms: We detect light, radiation, pressure, flow, level and acceleration. Our sensors can also be adapted specifically to your application or even developed individually. This will help you to save time and resources!

1 State-of-the-art production in our own clean rooms

Triple the experience and innovation

First Sensor is focused on three core markets: Industrial, Medical and Mobility. We support these markets with our international sales as well as uniformly controlled production processes. The development of tailor-made sensor solutions as well as the manufacturing of the products is specifically guided by your performance requirements.

Proximity to markets and customers is for us the key to economic success. The development and production of sensor solutions with you and for you is therefore the central focus of our business model. We see you and your markets from a future-oriented perspective and ask questions like: In what direction are the markets developing? What will be needed in the years ahead? Where can we offer you added value and a competitive advantage? The answer to these and similar questions is custom sensors and sensor system solutions from our company – smart, miniaturized and reliable.

This market- and customer-oriented strategy is clearly aligned to the core markets of industrial applications, medical technology as well as automotive and transport. These core markets all share common ground: They combine above-average growth and a technological challenge that can only be mastered by an innovative and professional company like First Sensor.

In the Industrial market First Sensor has many years of experience and expertise in development and production engineering, allowing it to offer a wide variety of high-quality sensor solutions that can be adapted to your specific requirements. The focus of the applications includes length measurement, radiation and security, smart building as well as industrial process control. Another complex field of application is aerospace. Here some of the requirements are very high, which in turn calls for our custom solutions.

First Sensor has been manufacturing and supplying sensor solutions for medical technology for over 30 years and has extensive experience in this field. Our specialists are dedicated to not simply providing sensor solutions but also finding and implementing the solution for the relevant measuring task that is the best possible in terms of technology and also affordable. Medical technology is there to save lives, enable patient healing, improve medical treatments and help those affected gain a better quality of life. That means we have to take a special degree of responsibility as a company – a challenge we gladly rise to.

We are about to enter a new era in mobility. Smart mobility has already become an everyday feature in new automobile models: With driver assistance systems from automatic start-stop systems and parking aids to options for semi-autonomous driving. The foreseeable future is set to witness fully autonomous vehicles that can transport their occupants safely and comfortably from A to B. First Sensor will accompany the automotive industry into this new era with its sensor solutions.

We work closely with you in the development of new sensor solutions right from the start. You describe your application, and we contribute the technical standards and our expertise. This means we can jointly configure a perfectly tailored solution. The spectrum ranges from wafers and individual sensor components to conventional sensors and smart sensor systems.

Industrial

Optical and radiation sensors for

- laser rangefinders
- laser scanners/LIDAR
- laser alignment systems
- encoders
- spectrometers
- baggage and container scanners
- passenger counters

Pressure, flow and level sensors for

- volumetric flow controllers
- filter monitoring
- leak detection
- level sensing
- industrial printers
- cabin air pressure

Inertial sensors for

- condition monitoring
- control and navigation systems

Highly accurate inertial sensors for condition monitoring

Medical

Optical and radiation sensors for

- computer tomographs
- videoscopes
- pulse oximeters
- blood sugar measuring devices
- gamma probes

Pressure, flow and level sensors for

- respiratory devices
- sleep diagnostic devices
- sleep apnea therapy devices (CPAP)
- spirometers
- anesthetic devices
- dialysis machines
- infusion pumps
- oxygen concentrators
- insufflators

Highly reliable pressure and flow sensors for respiratory devices

Mobility

Cameras and optical sensors for

- advanced driver assistance systems
  - LIDAR
  - ACC (Adaptive Cruise Control)
  - collision avoidance systems
  - traffic sign recognition
  - blind spot detection
  - lane departure warning

OEM pressure sensors for

- tank pressure measurement
- fuel delivery
- tank leakage diagnostics
- tank air intake and extraction
- brake booster systems
- start-stop systems
- power-assisted steering
- engine suspension
- air-conditioning systems
- exhaust gas recirculation systems
- filter monitoring

Camera systems and optical sensors for advanced driver assistance systems

Sensor solutions for industry

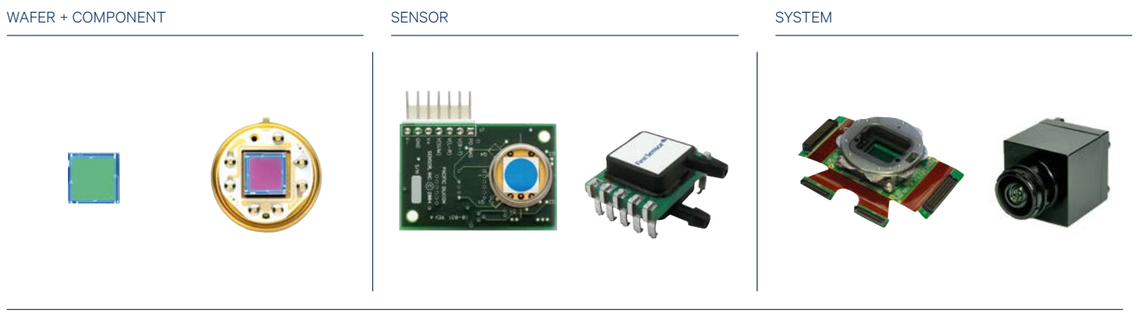
First Sensor offers innovative sensor solutions backed up by many years of technical manufacturing expertise. We define quality based on our superlative products, which make a reliable and lasting contribution to the continued success of our customers.

Sensors in industrial applications reveal the entire spectrum of parameters covered - light, radiation, pressure, flow, level, or acceleration. In this respect, sensors often form the core element in their products and solutions and have a decisive influence on the quality, economic efficiency, and safety of the application by controlling key process parameters. For this reason, we take great care in our development, production and service activities – working in accordance with certified processes and procedures. From bare sensor elements and media-isolated industrial transmitters to complex systems, we offer innovative sensor solutions and a broad spectrum of technologies across the entire value chain.

First Sensor has the technology, capacity, and experience to adapt and optimize its sensors to your specific applications and markets. We offer specialized technical expertise, comprehensive consultancy services and customized quality products for the core areas of length measurement, radiation and security, smart building, industrial process control and aerospace. We are the right partners for customized sensor technology if you do not have sufficient in-house development and production resources, if you want to limit cost and technology risks, or if you simply want to focus on your core activities. Save on time-consuming research - ask our experts about the optimum sensor solution for your industrial application. Our ultra-modern semiconductor production facility with its dedicated clean rooms allows you to plan flexible batch sizes to suit your needs.

We can give you the edge in terms of technology so that you can manufacture long-lasting measuring devices and machines of very high precision – for use in production and quality assurance, research and development or maintenance and monitoring. The application areas for our high-quality sensors in industry are extremely diverse: They can detect the smallest amounts of light in optical distance measurement. They help screen items of baggage and freight. They monitor air flows in HVAC systems. They recognize levels and pressures in tanks and can detect positions and acceleration when monitoring the condition of buildings.

The entire value added chain



Supply chain flexibility will become increasingly important for you. As a reliable partner, we offer a range of services from tailored solutions to integration in your value and supply chain. As a global provider of sensors, we maintain an extensive international presence - with our corporate headquarters in Germany as well as sales and production locations in Europe, America, and Asia. Talk to us - and reap the benefits of the perfect sensor solution from First Sensor for your specific industrial application.

1 State-of-the-art production in our own clean rooms

Length measurement

Industrial optical length measurement delivers swift and reliable measurement results with ultra-high precision over short and long distances. First Sensor develops and manufactures detector solutions for optical distance measuring devices such as laser rangefinders, laser scanners, LIDAR systems, and encoders. We optimize our photodiodes for your special requirements, for example, with reference to sensitivity, amplification, rise time, or capacitance.

Laser rangefinders

Laser rangefinders have numerous applications and are used, for example, to measure rooms and buildings in the construction sector and for distance measurement in industry. In most cases, the devices use a continuous laser beam with a modulated intensity and measure the phase shift of the laser beam reflected by the object in comparison to the output beam (phase measurement process). Laser rangefinders use sensitive avalanche photodiodes that enable them to cover ranges of up to 200 meters.

Our sensor solutions for laser rangefinders

Avalanche photodiodes (APDs) from First Sensor are optimized for various wavelengths from blue (400 nm) to infrared (1064 nm). Series 8 and 9 have their highest sensitivity at 650 to 850 nm or 905 nm and are used in many laser rangefinders. Series 10 is particularly suitable for all applications using Nd:YAG laser beam sources at 1064 nm. Optimized for the red wavelength range, Series 12 offers extremely fast response times and can be operated with low bias voltages.

1 Sensitive avalanche photodiodes for laser rangefinders

Laser scanners and LIDAR systems

In laser scanners and LIDAR systems, the environment is usually scanned with a pulsed laser beam and the reflection time of the signal from the object back to the detector is measured. The Time-of-Flight (TOF) reflection time measurement can be used over distances ranging from one meter up to several kilometers. To increase the range of the systems, very short laser pulses in the invisible NIR range are used. These enable a higher laser power compared to continuous wave lasers while still complying with eye safety requirements. During the scanning process, the systems gather individual distance points within an aggregate of points, from which three-dimensional images of the environment can be computed. The laser scanners deflect the laser beam using deflecting mirrors, which enables them to achieve very wide fields of vision. Some LIDAR systems also rotate around their own axis and offer 360° all-round visibility. Modern devices achieve very high data rates with over one million distance points per second.

Our sensor solutions for laser scanners and LIDAR systems

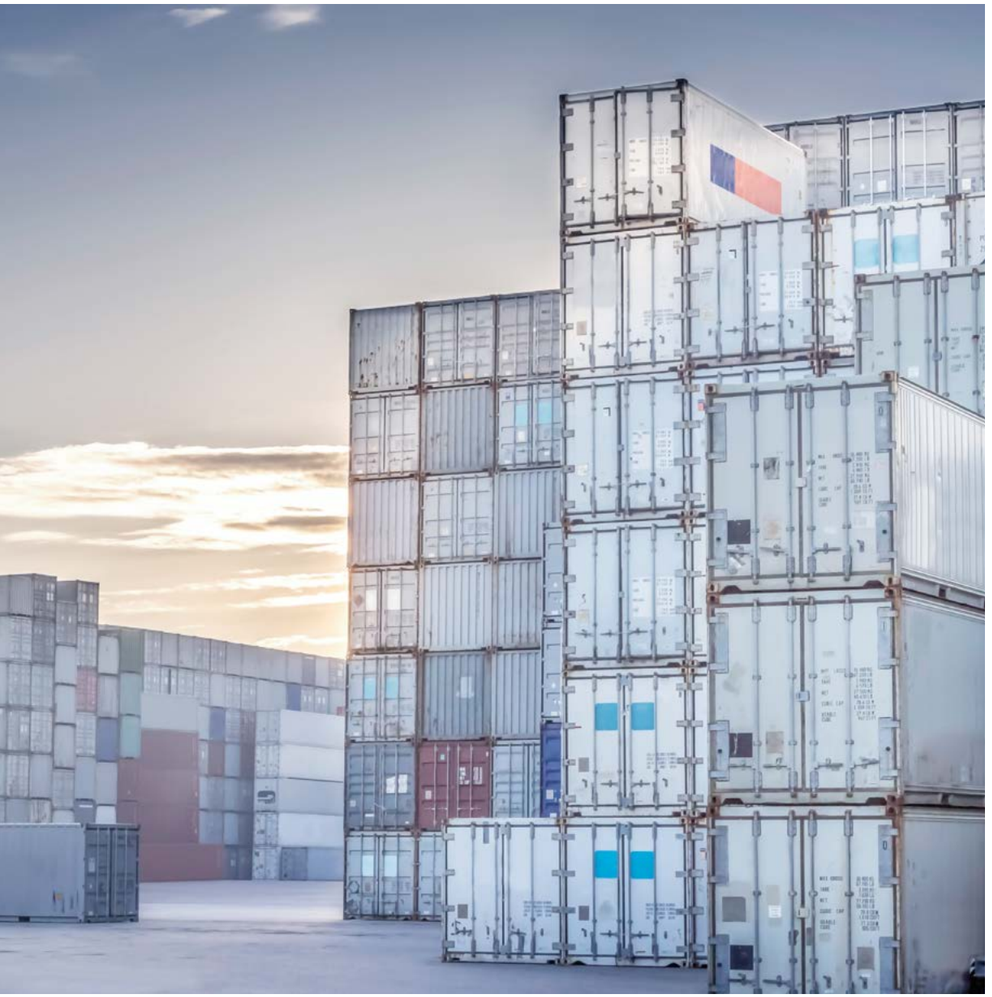
For measuring systems based on the reflection time process using light pulses of varying intensity in the nanosecond range, First Sensor offers highly sensitive avalanche photodiodes (APDs) with internal amplification across a wide dynamic range as well as wide bandwidths. To achieve the high spatial resolutions required in optical LIDAR systems, First Sensor develops APD arrays that consist of multiple sensor elements using, for example, 8, 16, 5 x 5 or 8 x 8 pixels. For the matrix arrays, development modules that simplify the process of testing the detector are also available.

PRODUCTS

Series 11: APDs with enhanced blue sensitivity
Series 12: APDs with enhanced red sensitivity
Series 8r: APDs with enhanced red/green sensitivity – 650 nm
Series 8: APDs optimized for high cut-off frequencies – 650-850 nm
Series 9: APDs with enhanced NIR sensitivity – 900 nm
Series 9.5: APDs with enhanced NIR sensitivity – 950 nm
Series 10: APDs with enhanced NIR sensitivity – 1064 nm
Customized sensors, modules and arrays

Radiation and security

Sea ports and airports use inspection and security systems such as container scanners, cargo scanners, and baggage scanners to screen and inspect vehicles, freight, and baggage. First Sensor offers a range of photodiodes and sensor systems for measuring ionizing radiation directly via the absorption in the crystal lattice or indirectly via the measurement of the luminescence radiation of a scintillation crystal.



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Freight inspection systems and baggage scanners

Freight inspection systems such as container scanners and cargo scanners screen and check vehicles and cargo in sea ports, in container terminals and at border crossings. Mobile freight inspection systems can be flexibly deployed at the area of application. Stationary drive-through systems are suitable for higher throughputs at a fixed location. With an output of up to 6 MeV, freight inspection systems can penetrate steel up to 30 cm thick. Airports use freight inspection systems and baggage scanners to carry out X-ray inspection of baggage and freight. In addition, X-ray scanners are used in forwarding agents, warehouses, and logistics companies.

Our sensor solutions for freight inspection systems and baggage scanners

For high-quality X-ray images with highly detailed resolution, precision detectors are essential. Photodiodes from First Sensor with very low dark current and low capacitance enable low-noise X-ray images with very high contrast.

The X7 PIN photodiodes are optimized for scintillator luminescence radiation in the visible wavelength range and feature an ultra-flat design (chip-scale package). Using the latest flip-chip technology, the chip is mounted on the carrier with its active area and the contacts facing down. The chip is illuminated from the back. This enables a flat chip surface without fragile bond wires, which is ideal for the precision mounting of a scintillation crystal. By means of solder bumps and surface mount technology (SMT), multiple X7 photodiode elements can be assembled to create larger linear or matrix arrays with very high fitting accuracy. First Sensor develops and manufactures custom specific arrays, sensors, and complete systems for OEM manufacturers of freight inspection systems and baggage scanners worldwide.

PRODUCTS

Series X: detectors for ionizing radiation
Series 7: fully depletable IR photodiodes
SiPM: silicon photomultipliers for ultra-low light levels
Customized sensors, modules and arrays

1 Photodiodes and sensor systems for container and cargo scanners

2 Large detector arrays for X-ray inspection of baggage and freight

Smart building

Today, modern building automation and HVAC systems intelligently match energy generation, energy distribution, air conditioning, and heat recovery to ensure that energy is used in a manner that saves resources and costs. First Sensor offers high-quality sensor solutions that range from individual sensors to complex customer-specific sensor systems that help to boost the energy efficiency of heating, ventilation, and air-conditioning systems.

HVAC systems

In HVAC systems, the ability to monitor volumetric flow rates and pressures in lines and rooms is decisive when it comes to operating heating, ventilation, and air-conditioning systems efficiently and economically. Pressure sensors are a central element for controlling the systems. To ensure compliance with strict legal requirements and to minimize energy costs, ever-decreasing measuring ranges as well as greater measuring sensitivities, accuracies, and long-term stabilities of the sensors are required. In addition, the pressure sensors must cope with particular requirements in HVAC systems, such as dust-laden air, and must be small and easy to integrate in OEM systems.

Our sensor solutions for HVAC systems

First Sensor offers a range of sensor technologies for measuring lowest differential pressures in volumetric flow controllers, ventilation ducts, rooms and filter monitoring.

Our flow-based LDE/LME/LMI differential pressure sensors operate according to the principle of thermal mass flow measurement of air which is conducted through a very small flow channel integrated in the sensor chip. This innovative sensor technology enables highly sensitive measurement of ultra-low pressures from 25 Pa (0.25 mbar) full scale with ulra-high resolution and offset stability. Due to the minimal gas flow, the sensors are highly resistant to dust, humidity, and long connection tubes

First Sensor's membrane-based piezoresistive pressure sensors from the HCL and HCLA series combine very high offset stability with low position sensitivity thanks to a special internal compensation technique. The silicon MEMS sensors achieve especially linear signal/pressure characteristic curves for pressure measuring ranges from 2.5 mbar full scale and offer analog and digital interfaces.

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1 Sensors for measuring differential pressures in HVAC systems

2 MEMS inertial sensors for condition monitoring

PRODUCTS

LDE/LME/LMI Series: ultra-low pressure sensors based on flow measurement
HCL/HCLA Series: piezoresistive low pressure sensors
WBI/WBA/WTA Series: thermal mass flow sensors
SI/SA Series: capacitive MEMS inertial sensors
Customized sensors, modules and systems

2

Condition monitoring of buildings

A new generation of miniaturized sensor-based monitoring systems uses precision MEMS inertial sensors to monitor structural changes, damage, and critical stress conditions of buildings and structures. In this way, the load exerted on bridges, for example, by usage, aging, and environmental influences such as wind and temperature is recorded and checked by a dense network of sensors at various locations. Micromachining inertial sensors are also suitable for condition monitoring of wind power systems, high-current cables, and pipelines.

Our sensor solutions for condition monitoring of buildings

First Sensor operates an innovative technology platform for manufacturing precision inertial sensors that can be flexibly adapted to your customer-specific requirements. The capacitive inclination and acceleration sensors are based on single crystal silicon sensor elements and the latest micromachining technology. The MEMS sensors achieve a very high signal-to-noise ratio as well as exceptional temperature stability and can detect the smallest changes in position or acceleration. The high aspect ratio microstructures (HARMS) guarantee ultra-low cross axis sensitivities. Furthermore, patented AIM (Air gap Insulated Microstructures) technology minimizes parasitic capacitances by insulating the active areas with an air gap.

Industrial process control

Industrial process control involves monitoring and controlling machinery, systems, and processes across a large number of industries: chemicals, pharmaceutics, biotechnology, energy, water/wastewater, oil, gas, plastic, paper, food, and beverages. Nowadays, industrial preparation, processing, and manufacturing systems are highly automated in order to ensure that raw materials and energy are consumed in a conservative and efficient manner. In this context, the ability to measure pressures, levels, and flow rates reliably and precisely in harsh, humid, and dusty environments and to measure aggressive, corrosive, explosive, and other liquids and gases is essential.

1

1 Submersible sensors and pressure transmitters for industrial process control

2 Sensors, electronic circuits, modules, and customized systems for aerospace applications

Level sensing

Level sensing is one of the most common applications in industrial process control. Key factors influencing the choice of a suitable level sensor include the size, geometry, and material of the vessel, the presence of equipment in the tank such as agitators, and the type of process medium. Level sensors from First Sensor for industrial process control include hydrostatic level sensing as well as optoelectronic level switches and ranges from simple limit value detection to precision continuous level sensing.

Our sensor solutions for hydrostatic level sensing

For level sensing in industrial process control systems, First Sensor supplies hydrostatic OEM submersible sensors and OEM pressure transmitters for the development and construction of plants, measuring systems, and devices. In addition, we can offer you customer-specific solutions and our comprehensive technical development support.

Pressure transmitters and submersible sensors for hydrostatic measurements are sophisticated and largely resistant to corrosive and aggressive substances because the pressure gage and housing for the sensors – depending on the surrounding medium – can be made of ceramic, stainless steel, or plastic.

Our range of pressure transmitters and submersible sensors comprises the compact CTE family with slim housings, the extremely rugged BTE pressure transmitters made of stainless steel, and the KTE family with housings and pressure connections made of plastic for high compatibility with many corrosive and aggressive liquid media. Furthermore, we offer sensors with a flush-mount membrane that prevent the build-up of deposits and are easy to clean. We can adapt all pressure transmitters and submersible sensors quickly and flexibly to your specific requirements, for example, in terms of calibration, mechanical structure, process connection, electrical connection, or output signal.

PRODUCTS

CTE Series: compact pressure transmitters and submersible sensors with small diameters
KTE Series: pressure transmitters and submersible sensors with very high media compatibility
BTE Series: rugged pressure transmitters and submersible sensors
Sensor adaptations and new developments

Aerospace

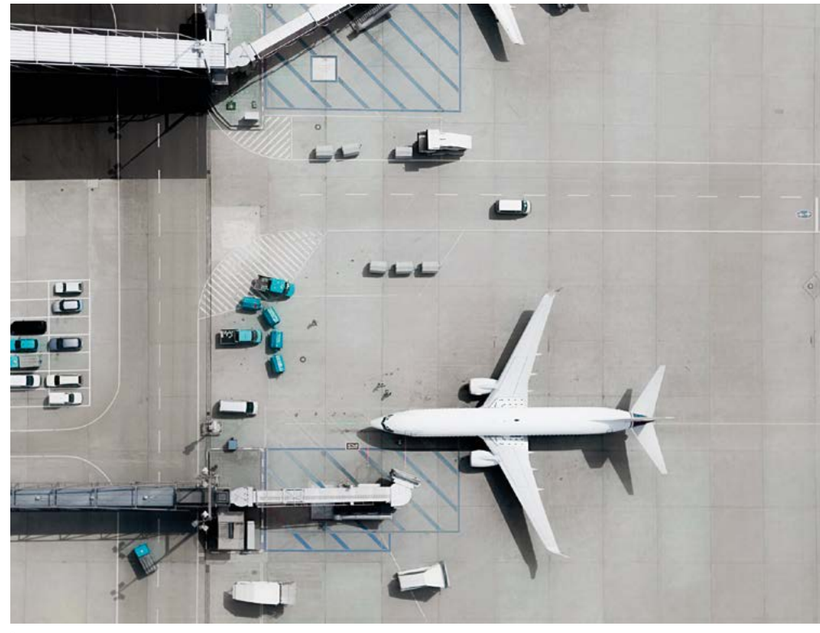
Sensors, electronic circuits, modules, and customized systems have a decisive influence on the quality, economic efficiency and safety of aerospace applications. Extreme environmental conditions such as temperature changes, acceleration, and vibrations place very high demands on the reliability and resilience of the products.

First Sensor Lewicki GmbH, which is owned by First Sensor AG, has over 45 years of application expertise and experience in aerospace technology and operates development, production, and service activities according to processes and procedures certified to EN 9100. To check the reliability of our products, we conduct stress tests (design margin tests) as well as screening and qualification, for example, according to ESA standards. The use of the latest thick-film hybrid technology enables the construction of very small, robust, and ultra-reliable electronic modules and circuits.

Our sensor solutions for aerospace

The NuSTAR X-ray satellite launched in 2012 uses two-dimensional position-sensitive diodes (PSDs) from First Sensor to manage the continuous alignment of the telescope lens relative to the sensor unit.

First Sensor supplies precision inertial sensors for use in control and navigation applications for aircraft and unmanned spacecraft. The capacitive inclination and acceleration sensors are based on single crystal silicon sensor elements and the latest micromachining technology (HARMS). The innovative technology platform makes it possible to flexibly adjust the inertial sensors to your specific requirements. Our precision piezoresistive silicon pressure sensors monitor and control the cabin air pressure in aircraft. In addition, First Sensor develops and manufactures multi-sensor modules that integrate a large number of components such as sensors, valves, pumps, switches, and micro-controllers to create compact plug-and-play solutions.



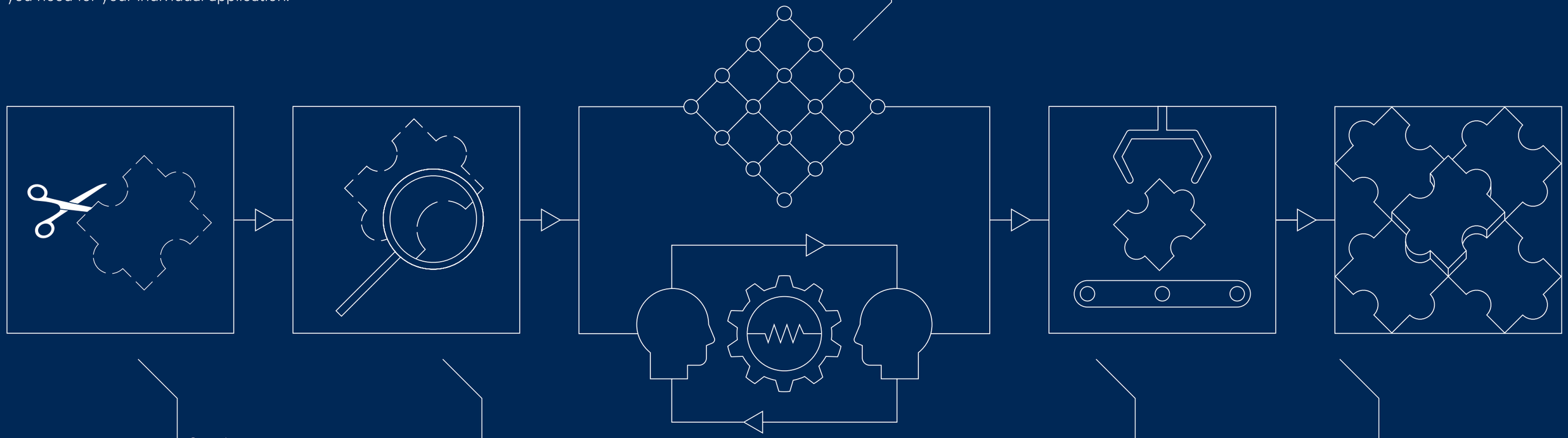
2

PRODUCTS

PSD Series 6: position-sensitive IR diodes with minimal dark current
PSD Series 7: fully depletable position-sensitive IR diodes
SI/SA Series: capacitive MEMS inertial sensors
HDI Series: piezoresistive pressure sensors with digital signal conditioning
Customized sensors, modules and systems

Sensor solutions

Together we can plan, develop and guide your entire sensor system project, tailored to your requirements. We offer a wide range of application-optimized standard products or customized solutions - products providing exactly what you need for your individual application.



Step_1
Idea

No matter whether you already have the full specifications for your sensor or merely a rough idea – our sales department will be pleased to advise you about the right solution in terms of implementation and cost. We know about the underlying conditions associated with production engineering and are familiar with the manufacturing time frames often spanning many years. We would like to utilize our expertise and experience to establish a long-standing and trusting partnership with you.

Let's talk about your ideas.

Step_2
Requirements-oriented analysis

We are specialized in the customized development and production of sensor solutions. Our highly qualified planning and manufacturing expertise enables us to help shape the entire value added chain at in-house production sites – from the chip up to final qualification. Together with you, we can realize optimum solutions for your successful applications with unique selling propositions.

We support your specific application.

Step_3.1
Wide-ranging product portfolio

Our products are renowned for their efficiency and accuracy. Technical excellence, precision and reliability take top priority when transforming your requirements into reality. Our product platforms have been specially developed for the demands of your application and can also be adapted individually as required.

Find everything you need.

Step_3.2
Individual product development

Our Research & Development and our production sites are specialized in finding and implementing individual solutions for your requirements. Components, modules and sensor systems are developed in close cooperation with you in a Stage-Gate-Process®.

We offer tailored individuality.

Step_4
Production and quality assurance

Utilize our flexible production capacity – from rapid prototype manufacture via medium-sized quantities to order-based, cost-efficient series production involving millions of units. We carry out our development, validation, qualification and reliability approval work along wi dards and certifications specific to your sector. At our different production sites we offer application-specific measurement technologies and master various calibration methods.

We customize our production.

Step_5
Implementation

Our products and processes are individually tailored to your needs, offering long-term availability and a high level of specialization. As a reliable partner oriented to continuity, we are there for you with proven project management. We are always pleased to inspire ideas for your further developments in all stages of the value chain. Come to us for your innovation process.

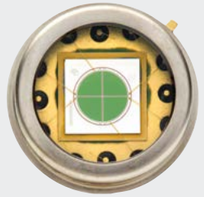
Together we realize your solution.

Detect more, achieve more – our products

What would you like to find out today? Or what would your product, your customer or a user like to find out? Whether it involves light, radiation, pressure, flow, level, or acceleration – we know which sensor is right for you and will provide you with the precise value.

Our sensor modules and systems immediately convert this value into results and signals that can be used digitally, thereby giving your product eyes, ears, or a sense of touch. Needless to say, we can adapt all our products or develop them specially to fit your application. You will already find the right solution for many applications in our broad and field-tested range of high-performance product platforms. This will help you to save time and resources!

Light



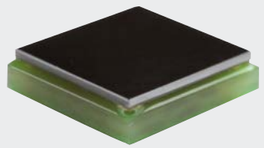
Optical sensors
– PIN photodiodes
– avalanche photodiodes (APDs)
– photodiode arrays
– position-sensitive diodes (PSDs)
– silicon photomultipliers (SiPMs)

Optoelectronic modules

Emitters
– laser diodes
– LEDs

HDR CMOS cameras

Radiation



Detectors for ionizing radiation
– with and without scintillator
– photodiode arrays
– modules

Pressure

MEMS pressure sensor elements and components

Pressure sensors
– uncompensated
– temperature compensated
– with integrated signal conditioning
– based on flow measurement
– with increased media compatibility
– for corrosive liquids and gases

Pressure transmitters
– for low pressure
– for corrosive liquids and gases

OEM pressure sensors

Flow

Thermal mass flow sensors

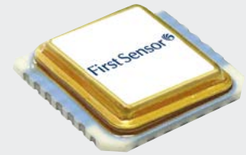
Sensors for volumetric flow measurement

Level

Hydrostatic liquid level sensors

Level switches

Acceleration



MEMS inertial sensors
– inclination sensors
– acceleration sensors

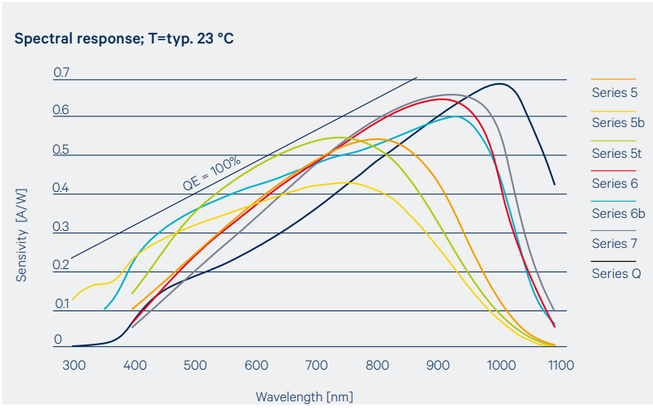
Optical sensors

First Sensor develops and manufactures a large selection of photodetectors with high sensitivity, high speed, and low dark current which can be adapted to your specific requirements. Our sensors are optimized for ultraviolet, visible, or infrared light as well as ionizing radiation. Package solutions include surface-mount (SMD) and through-hole (THD) devices. Further, we provide silicon photomultipliers for the detection of lowest light levels.

PIN photodiodes

Silicon features unique properties for light detection. Silicon PIN photodiodes are used to convert photonic energy into electrical current and achieve very fast rise times. First Sensor develops and manufactures PIN photodiodes in standard product lines optimized for specific wavelength ranges as well as customized detectors adapted to your specific requirements. Additionally, we offer quadrant PIN photodiodes with four optically active areas.

Spectral response; T=typ. 23 °C



PIN series	Optimized for	Special features
Series 6b	**350...650 nm**	**Blue/green enhanced**
Series 5b	**350...650 nm**	**High speed blue-enhanced Epitaxy PIN-diode**
Series 5t	**500...900 nm**	**High speed red-enhanced Epitaxy PIN-diode**
Series 5	**500...900 nm**	**High speed NIR-enhanced Epitaxy PIN-diode**
Series 6	**700...1000 nm**	**General purpose, low dark current, fast response**
Series 7	**700...1000 nm**	**Low capacitance, full depletable design available**
Series Q	**900...1100 nm**	**Enhanced NIR sensitivity, low voltage, fully depletable, low capacitance**
Series i	**900...1700 nm**	**InGaAs photodiode, high IR sensitivity, low dark current**

Applications:
Photometry
Pulsed light detection
Analytical instruments
Fluorescence detection
Spectroscopy
High speed optical communication
Laser power monitoring
Fiber optic light monitoring
Bar code readers
YAG laser detection

Series 6b: blue/green-sensitive photodiodes

PIN photodiodes with enhanced sensitivity in blue and green spectral range.

Order #	Chip	Package	Active area Size (mm) / Area (mm²)	Dark current (nA) 5 V	Rise time (ns) 410 nm. 5 V. 50 Ω
501429	**PS1-6b**	**TO52S1**	**1 x 1 / 1**	**0.05**	**10**
501430	**PS1-6b**	**LCC6.1**	**1 x 1 / 1**	**0.05**	**10**
501297	**PC5-6b**	**TO5**	**Ø 2.52 / 5**	**0.1**	**20**
501242	**PS7-6b**	**TO5**	**2.7×2.7 / 7**	**0.15**	**25**
501229	**PC10-6b**	**TO5**	**Ø 3.57 / 10**	**0.2**	**45**
501241	**PS13-6b**	**TO5**	**3.5×3.5 / 13**	**0.25**	**50**
501244	**PS33-6b**	**TO8**	**5.7×5.7 / 33**	**0.6**	**140**
501258	**PS100-6b**	**LCC10S**	**10×10 / 100**	**1**	**200**
501135	**PS100-6b**	**CERpinS**	**10×10 / 100**	**1**	**200**
501045	**PS100-6b**	**CERpinG**	**10×10 / 100**	**1**	**200**

Selected chips are also available with band pass filter

Order #	Chip	Package	Active area (mm²)	BP Center (mm)	BP transmission (%)	BP FWHM (nm)
501408	**PR20-6b**	**TO5i**	**20**	**488**	**70**	**10**
501409	**PR20-6b**	**TO5i**	**20**	**550**	**50**	**10**
501284	**PR20-6b**	**TO5i**	**20**	**633**	**75**	**10**
501410	**PR20-6b**	**TO5i**	**20**	**680**	**50**	**10**

Series 5b: high speed blue-sensitive photodiodes

This range of high-speed epitaxial photodiodes is designed specifically for low operating voltages between 3 and 5 V, making them ideal for VIS and NIR applications in conjunction with CMOS components.

Order #	Chip	Package	Active area Size (mm) / Area (mm²)	Dark current (nA) 3.5 V	Rise time (ns) 405 nm, 3.5 V, 50 Ω
501424	**PS1.0-5b**	**TO52S1**	**1.0×1.0 / 1**	**0.01**	**1.3**
501428	**PS1.0-5b**	**LCC6.1**	**1.0×1.0 / 1**	**0.01**	**1.3**
501425	**PS7-5b**	**TO5**	**2.7×2.7 / 1**	**0.5**	**5**
501426	**PC10-5b**	**TO5**	**Ø 3.57 / 10**	**0.5**	**6**
501427	**PS13-5b**	**TO5**	**3.5×3.5 / 13**	**1**	**6**

Optical sensors

Series 5t: high speed red-sensitive photodiodes

This range of high-speed epitaxial photodiodes is designed specifically for low operating voltages between 3 and 5 V, making them ideal for VIS and NIR applications in conjunction with CMOS components.

Order #	Chip	Package	Active area Size (mm) / Area (mm²)	Dark current (nA) 3.5 V	Rise time (ns) 850 nm, 3.5 V, 50 Ω
501126	PS0.25-5t	LCC6.1	0.5×0.5 / 0.25	0.01	0.4
501434	PS0.25-5t	SMD1206	0.5×0.5 / 0.25	0.01	0.4
501125	PC0.55-5t	LCC6.1	Ø 0.84 / 0.55	0.01	1
501289	PC0.55-5t	T1 3/4	Ø 0.84 / 0.55	0.01	1
501290	PC0.55-5t	T1 3/4 black	Ø 0.84 / 0.55	0.01	1
501127	PS1-5t	LCC6.1	1.0×1.0 / 1	0.01	1

Series 5: high speed NIR-sensitive photodiodes

These high-speed epitaxial photodiodes are ideal for VIS and NIR applications with low operating voltages.

Order #	Chip	Package	Active area Size (mm) / Area (mm²)	Dark current (nA) 3.5 V	Rise time (ns) 405 nm, 3.5 V, 50 Ω
500122	PS0.25-5	TO52S1	0.5×0.5 / 0.25	0.1	0.4
500119	PS0.25-5	TO52S3	0.5×0.5 / 0.25	0.1	0.4
500973	PS0.25-5	LCC6.1	0.5×0.5 / 0.25	0.1	0.4
500116	PS0.25-5	SMD1206	0.5×0.5 / 0.25	0.1	0.4
501257	PC0.55-5	TO5251	Ø 0.84 / 0.55	0.2	1
501124	PC0.55-5	LCC6.1	Ø 0.84 / 0.55	0.2	1
500127	PS1.0-5	TO52S1	1.0×1.0 / 1	0.2	1.5
500128	PS1.0-5	TO52S3	1.0×1.0 / 1	0.2	1.5
501128	PS1.0-5	LCC6.1	1.0×1.0 / 1	0.2	1.5
501291	PS7-5	TO5	2.7×2.7 / 7	0.5	11
501218	PS11.9-5	TO5	3.45×3.45 / 11.9	1	3
500097	PC20-5	TO8	Ø 5.05 / 20	2	3.5
501292	PS33-5	TO8	5.7×5.7 / 33	2	3.5
501011	PS100-5	LCC10S	10x10 / 100	2	5
501433	PS100-5	CERpinG	10x10 / 100	2	5

Series 6: IR photodiodes with minimal dark current

High-performance PIN photodiodes for low-capacitance light detection as well as for alpha, beta, gamma and X-ray radiation detection.

Order #	Chip	Package	Active area Size (mm) / Area (mm²)	Dark current (nA) 3.5 V	Rise time (ns) 850 nm, 10 V, 50 Ω
500151	PC1-6	TO52S1	Ø 1.13 / 1	0.05	10
500482	PC1-6	TO52S3	Ø 1.13 / 1	0.05	10
501214	PC5-6	TO5	Ø 2.52 / 5	0.1	13
501221	PS7-6	TO5	2.66×2.66 / 7	0.1	15
501193	PC10-6	TO5	Ø 3.57 / 10	0.2	20
501246	PS13-6	TO5	3.5×3.5 / 13	0.2	20
500113	PC20-6	TO8	Ø 5.05 / 20	0.3	25
501298	PS33-6	TO8	5.7×5.7 / 33	0.4	25
500103	PC50-6	TO8S	Ø 7.98 / 50	0.5	30
500082	PC100-6	BNC	Ø 11.28 / 100	1	40
501264	PS100-6	BNC	10×10 / 100	1	40
501435	PS100-6	LCC10S	10×10 / 100	1	40
500149	PS100-6	CERpinG	10×10 / 100	1	40

Series 6 / quadrant PIN photodiodes (QP)

Order #	Chip	Package	Active area Size (mm) / Area (mm²)	Gap (µm) 150 V	Dark current (nA) 10 V	Capacitance (pf) 10 V	Rise time (ns) 850 nm, 10 V , 50 Ω,
501222	QP1-6	TO52	Ø 1.13 / 4x0.25	16	0.1*	1	20
501040	QP5-6	TO5	Ø 2.52 / 4x1.25	24	0.2*	3	20
501254	QP5.8-6	TO5	2.4x2.4 / 4x1.45	50	0.4*	3.5	20
501256	QP10-6	TO5	Ø 3.57 / 4x2.5	28	0.5*	5	20
500140	QP20-6	TO8S	Ø 5.05 / 4x5	34	1.0*	10	30
500732	QP50-6	TO8S	Ø 7.8 / 4x12.5	18	2.0*	25	40
500142	QP50-6	TO8S	Ø 7.8 / 4x12.5	42	2.0*	25	40
501416	QP50-6	TO8S flat	Ø 7.8 / 4x12.5	18	2.0*	25	40
501417	QP50-6	TO8S flat	Ø 7.8 / 4x12.5	42	2.0*	25	40
501276	QP100-6	LCC10G	10x10 / 4x25	50	4.0*	50	40
50127601	QP100-6	LCC10S	10x10 / 4x25	50	4.0*	50	40

* per segment

Optical sensors

Series 7: fully depletable IR photodiodes

Optimized for the most demanding applications requiring minimal capacitance.

Order #	Chip	Package	Active area Size (mm) / Area (mm²)	Dark current (nA) 10 V / 150 V	Capacitance (pf) 10 V / 150 V	Rise time (ns) 905 nm, 50 Ω, 10 V / 150 V
501285	PC5-7	TO8i	Ø 2.52 / 5	0.05 / 0.25	6 / 2.5	45 / 6
501286	PC10-7	TO8i	Ø 3.57 / 10	0.1 / 0.5	12 / 4.5	50 / 6
501287	PC10-7	TO8Si	Ø 5.05 / 20	0.2 / 1	20 / 8	50 / 6
501317	PS100-7	LCC10G	10×10 / 100	1.5 / 10	90 / 32	50 / 6

Series 7 / quadrant PIN photodiodes (QP)

Order #	Chip	Package	Active area Size (mm) / Area (mm²)	Dark current (nA) 10 V / 150 V	Capacitance (pf) 10 V / 150 V	Rise time (ns) 850 nm, 50 Ω, 10 V / 150 V
501319	QP100-7	LCC10G	10×10 / 4×25	2* / 10*	25* / 13*	50 / 6

* per segment

Series Q: photodiodes for 1064 nm

These photodiodes are ideal for laser rangefinders or any applications using YAG lasers or similar NIR radiation sources. The components are available as single detectors, quadrant detectors or surface arrays.

Order #	Chip	Package	Active area Size (mm) / Area (mm²)	Dark current (nA) 150 V	Rise time (ns) 1064 nm, 150 V, 50 Ω
501446	PC10-Q	TO8i	Ø 3.57 / 10	5	14
501447	PC20-Q	TO8Si	Ø 5.05 / 20	15	14
501448	PC50-Q	TO8Si	Ø 8 / 50	40	14
501273	PS100-Q	LCC10G	10×10 / 100	80	14

Series Q / quadrant PIN photodiodes (QP)

Order #	Chip	Package	Active area Size (mm) / Area (mm²)	Dark current (nA) 150 V	Rise time (ns) 1064 nm, 180 V, 50 Ω
501049	QP22-Q	TO8S	Ø 5.3 / 4×5.7	1.5*	12
501048	QP45-Q	TO8S	6.7×6.7 / 4×10.96	8*	12
501275	QP45-Q	LCC10G	6.7×6.7 / 4×10.96	8*	12
501526	QP45-Q	TO8Si with heater	6.7×6.7 / 4×10.96	8*	12
501272	QP100-Q	LCC10G	10×10 / 4×25	6.5*	12
500798	QP154-Q	TO1032i	Ø 14.0 / 4×38.5	10*	12
501313	QP154-Q	TO1081i with heater	Ø 14.0 / 4×38.5	10*	12

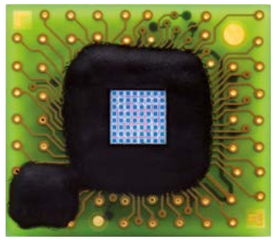
* pro Segment

Series i / InGaAs-Detektoren: low dark current, high sensitivity

First Sensor offers large-area InGaAs PIN photodiodes with active sensor surfaces up to 3 mm in diameter. The diodes feature low dark currents and high sensitivity up to 1700 nm wavelength. A model enhanced for the visible wavelength range is also available. Housing options include both hermetic TO solutions as well as SMD versions. Ask us about your specific sensor solution.

Order #	Chip	Package	Active area Size (mm) / Area (mm²)	Spectral Response (A/W) at 650 nm / 1550 nm	Dark current (nA) at 5V	Capacitance (pF) at 5 V	Wavelength (nm)
501201	PC0.7-i	LCC6.1	1.0 / 0.7	0.05 / 0.95	2	70	900...1700
501203	PC0.7-i	TO52S1	1.0 / 0.7	0.05 / 0.95	2	70	900...1700
501202	PC0.7-ix	LCC6.1	1.0 / 0.7	0.3 / 0.95	2	70	900...1700
501204	PC0.7-ix	TO52S1	1.0 / 0.7	0.3 / 0.95	2	70	900...1700
501251	PC2.6-i	TO5i	2.0 / 2.6	0.05 / 0.95	10	250	900...1700
501266	PC7.1-i	TO5i	3.0 / 7.1	0.05 / 0.95	25	700	900...1700

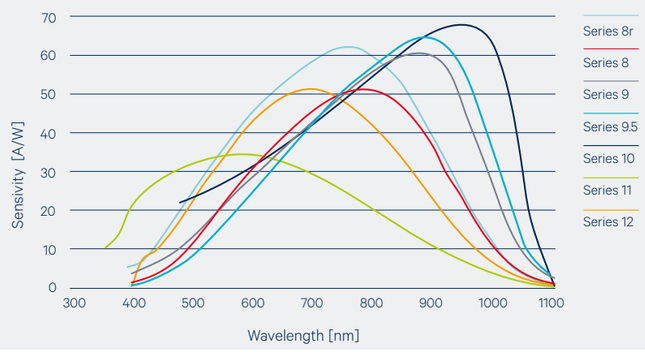
Optical sensors



Avalanche photodiodes (APDs)

Silicon avalanche photodiodes are optical detectors with an internal gain mechanism capable of a high gain bandwidth product. Due to their very high sensitivity avalanche photodiodes are ideally suited for measurements of very low light levels. First Sensor provides single element APDs as well as linear and matrix APD arrays with multiple active areas e.g. with 8, 16, 5 x 5 or 8 x 8 pixels.

Spectral response; T=typ. 23 °C , M = 100



APD series	Optimized for	Special features
Series 11	**350...550 nm**	**Blue enhanced, high speed**
Series 12	**550...750 nm**	**Ultra-low temperature coefficient, flat frequency response up to 3 GHz**
Series 8r	**620...750 nm**	**Optimized for 650 nm, fast rise time, low capacitance, flat gain curve**
Series 8	**750...820 nm**	**High speed, low temperature coefficient, high gain bandwidth product**
Series 9	**750...930 nm**	**Fast rise time at higher NIR sensitivity, high gain**
Series 9.5	**800...950 nm**	**Excellent responsivity in 950 nm range, fast rise time, low dark current**
Series 10	**900...1100 nm**	**Sensitivity at 1064 nm close to physical limits**

Applications:
Laser range finder
Laser distance meter
Laser scanners/LIDAR
Shape recognition
Collision warning
High speed optical communication
Laser alignment
Scintillator luminescence detection,
Photometry
YAG laser detection
Fluorescence detection

Series 11: with enhanced blue sensitivity

With a quantum yield > 70 % at 400 nm and maximum sensitivity at 600 nm, these components are particularly suited to biomedical applications.

Order #	Chip	Package	Active area Size (mm) / Area (mm²)	Dark current (nA) 3.5 V	Breakdown voltage	Rise time (ns) M = 100, 410 nm, 50 Ω
500970	**AD800-11**	**TO52S1**	**Ø 0.8 / 0.5**	**1**	**90 - 240***	**1**
500967	**AD1900-11**	**TO5i**	**Ø 1.95 / 3**	**5**	**90 - 240***	**2**

* Binning available

Series 12: with enhanced red sensitivity

These components are characterized by their high speed, particularly in the visible spectral range.

Order #	Chip	Package	Active area Size (mm) / Area (mm²)	Spectral Responsivity (A/W) 660 nm, M = 100	Capacitance (pF) M = 100	Cut-off frequency (GHz) 660 nm, 50 Ω
501828	**AD100-12**	**LCC6.1**	**Ø 0.1 / 0.008**	**50**	**typ. 0.5**	**typ. 3, min. 2**
501831	**AD100-12**	**TO52S1**	**Ø 0.1 / 0.008**	**50**	**typ. 0.5**	**typ. 3, min. 2**
501157	**AD230-12**	**LCC6.1**	**Ø 0.23 / 0.042**	**50**	**typ. 1.5**	**typ. 3, min. 2**
501162	**AD230-12**	**TO52S1**	**Ø 0.23 / 0.042**	**50**	**typ. 1.5**	**typ. 3, min. 2**
501155	**AD500-12**	**LCC6.1**	**Ø 0.5 / 0.196**	**50**	**typ. 4.5**	**typ. 3, min. 2**
501163	**AD500-12**	**TO52S1**	**Ø 0.5 / 0.196**	**50**	**typ. 4.5**	**typ. 3, min. 2**

Selected chips are also available with bandpass (BP) filter

Artikel #	Chip	Package	Active area (mm)	BP Zentrum (nm)	BP Transmission (%)	BP FWHM(nm)
501829	**AD100-12**	**LCC6.1f**	**Ø 0.1**	**635**	**>90**	**55**
501830	**AD100-12**	**LCC6.1f**	**Ø 0.1**	**635**	**>85**	**65**
501156	**AD230-12**	**LCC6.1f**	**Ø 0.23**	**635**	**>90**	**55**
501820	**AD230-12**	**LCC6.1f**	**Ø 0.23**	**635**	**>85**	**65**
501154	**AD500-12**	**LCC6.1f**	**Ø 0.5**	**635**	**>90**	**55**
501819	**AD500-12**	**LCC6.1f**	**Ø 0.5**	**635**	**>85**	**65**

Optical sensors

Series 8r: with enhanced red/green sensitivity – 650 nm

The Series 8r offers high sensitivities in the red and green wavelength range and is optimized for 650 nm. The new photodiodes are ideal for applications which demand fast rise times and low capacitance such as laser distance meters (LDM), laser rangefinders (LRF), high speed photometry as well as fiber optical communication.

Order #	Chip	Package	Active area Size (mm) / Area (mm²)	Dark current (nA), M = 100	Breakdown voltage (V)	Rise time (ns) M = 100 , 650 nm, 50 Ω
501487	AD230-8r	TO52S1.1	Ø 0.23 / 0.04	0.2	80–160*	0.180
501488	AD230-8r	LCC6.1	Ø 0.23 / 0.04	0.2	80–160*	0.180

* Binning available

Series 8: optimized for high cut-off frequencies – 650-850 nm

Due to their high gain and speed, these APDs are suitable for many industrial applications such as distance measurement, laser scanning and optical communication.

Order #	Chip	Package	Active area Size (mm) / Area (mm²)	Dark current (nA) M = 100	Breakdown voltage (V)	Rise time (ns) M = 100, 905 nm, 50 Ω
501810	AD100-8	LCC6.1	Ø 0.1 / 0.008	0.05	80–160*	<0.180
500011	AD100-8	TO52S1	Ø 0.1 / 0.008	0.05	80–160*	<0.180
501171	AD100-8	TO52S3	Ø 0.1 / 0.008	0.05	80–160*	<0.180
501078	AD230-8	LCC6.1	Ø 0.23 / 0.04	0.3	80–160*	0.18
500019	AD230-8	TO5251	Ø 0.23 / 0.04	0.3	80–160*	0.18
500022	AD230-8	TO52S3	Ø 0.23 / 0.04	0.3	80–160*	0.18
501496	AD230-8	ODFN2x2	Ø 0.23 / 0.04	0.3	80–160*	0.18
501077	AD500-8	LCC6.1	Ø 0.5 / 0.2	0.5	80–160*	0.35
500030	AD500-8	LCC6.1	Ø 0.5 / 0.2	0.5	80–160*	0.35
500305	AD500-8	TO52S2 (lens)	Ø 0.5 / 0.2	0.5	80–160*	0.35
500155	AD500-8	TO52S3	Ø 0.5 / 0.2	0.5	80–160*	0.35
500947	AD800-8	TO52S1	Ø 0.8 / 0.5	2	80–240*	0.7
501117	AD1100-8	TO52S1	Ø 1.13 / 1	4–6	80–240*	1
500015	AD1900-8	TO5i	Ø 1.95 / 3	15	80–200*	1.4
501194	AD3000-8	TO5i	Ø 3 / 7.07	30	80–200*	2
500160	AD5000-8	TO8i	Ø 5 / 19.63	60	80–200*	3

* Binning available

Selected chips are also available with bandpass (BP) filter

Order #	Chip	Package	Active area (mm)	BP (nm)	BP Transmission (%)	BP FWHM (nm)
501811	AD100-8	LCC6.1f	Ø 0.1	635	>90	55
501812	AD100-8	LCC6.1f	Ø 0.1	655	>85	65
501079	AD230-8	LCC6.1f	Ø 0.23	635	>90	55
501805	AD230-8	LCC6.1f	Ø 0.23	655	>85	65
501076	AD500-8	LCC6.1f	Ø 0.5	635	>90	55
501809	AD500-8	LCC6.1f	Ø 0.5	655	>85	65

Series 9: with enhanced NIR sensitivity – 900 nm

These avalanche photodiodes were developed specifically for the laser radar system LIDAR and laser rangefinders. The series provides fundamental technology for the development of arrays with multiple individual sensors, e.g. 8, 16, 32 pixels.

Order #	Chip	Package	Active area Size (mm) / Area (mm²)	Dark current (nA) M = 100	Breakdown voltage (V)	Rise time (ns) M = 100. 905 nm. 50 Ω
500020	AD230-9	TO52S1	Ø 0.23 / 0.04	0.5	160–240*	0.5
500023	AD230-9	TO52S3	Ø 0.23 / 0.04	0.5	160–240*	0.5
501123	AD230-9	LCC6.1	Ø 0.23 / 0.04	0.5	160–240*	0.5
501557	AD230-9	ODFN2x2	Ø 0.23 / 0.04	0.5	160–240*	0.5
500031	AD500-9	TO5251	Ø 0.5 / 0.2	0.8	160–240*	0.55
500306	AD500-9	TO52S2	Ø 0.5 / 0.2	0.8	160–240*	0.55
500156	AD500-9	TO52S3	Ø 0.5 / 0.2	0.8	160–240*	0.55
501122	AD500-9	LCC6.1	Ø 0.5 / 0.2	0.8	160–240*	0.55
501196	AD800-9	TO52S1	Ø 0.8 / 0.5	2	160–240*	0.9
501197	AD1100-9	TO52S1	Ø 1.13 / 1	4	160–240*	1.3
501208	AD1500-9	TO5i	Ø 1.5 / 1.77	2	160–240*	2
501198	AD3000-9	TO5i	Ø 3 / 7.07	30	160–240*	2
50016101	AD5000-9	TO5i	Ø 5 / 19.63	60	160–240*	3

* Binning available

Selected chips are also available with bandpass (BP) filter

Order #	Chip	Package	Active area (mm)	BP Center (nm)	BP Transmission (%)	BP FWHM (nm)
501265	AD230-9	TO52S1F2	Ø 0.23	905	>90	45
501817	AD230-9	LCC6.1f	Ø 0.23	905	>90	45
500590	AD500-9	TO52S1F2	Ø 0.5	905	>90	45
501818	AD500-9	LCC6.1f	Ø 0.5	905	>90	45

Optical sensors

Series 9 / multi-element arrays

Order #	Chip	Package	
501099	8AA0.4-9	SOJ22GL	8 elements, QE > 80 % at 760-910 nm with NTC
501098	16AA0.13-9	SOJ22GL	16 elements, QE > 80% at 760-910 nm with NTC
500038	16AA0.13-9	DIL18	16 elements, QE > 80 % at 760-910 nm
501097	16AA0.4-9	SOJ22GL	16 elements, QE > 80 % at 760-910 nm
50130802	25AA0.04-9	BGA	25 (5x5) elements, QE >80 % at 760-910 nm with PTC
50130702	64AA0.04-9	BGA	64 (8x8) elements, QE > 80 % at 760-910 nm with PTC

Series 9 / quadrant APDs (QA)

Order #	Chip	Package	
501207	QA4000-9	TO8Si	QE > 80 % at 760-910 nm

Series 9.5: with enhanced NIR sensitivity – 950 nm

These avalanche photodiodes were developed specifically for laser rangefinding and laser scanning applications such as safety scanners, 3D-mapping, environmental monitoring and high resolution LIDAR systems for autonomous driving. The series provides fundamental technology for specific development of custom-designed solutions e.g. different geometries, packages and arrays.

Order #	Chip	Package	Active area Size (mm) / Area (mm²)	Dark current (nA) M = 100	Breakdown voltage (V)	Rise time (ns) M = 100, 905 nm, 50 Ω
501325	AD500-9.5	LCC6.1	Ø 0.5 / 0.2	0.5	260–340*	1,6

Series 10: with enhanced NIR sensitivity – 1064 nm

These avalanche photodiodes are suitable for laser rangefinders or any applications using YAG lasers or similar NIR radiation sources.

Order #	Chip	Package	Active area Size (mm) / Area (mm²)	Dark current (nA) M = Vop	Breakdown voltage (V)
500953	AD500-10	TO5i	Ø 0.5 / 0.2	1.5	220-600*
501233	AD800-10	TO5i	Ø 0.8 / 0.5	3	220-600*
500883	AD1500-10	TO5i	Ø 1.5 / 1.77	7	220-600*
50123401	AD4000-10	TO8Si	Ø 4 / 12.56	50	220-600*

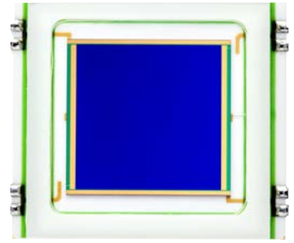
* Binning available

Series 10 / quadrant APDs (QA)

Order #	Chip	Package	
501174	QA4000-10	TO8Si	Quadrant avalanche photodiode, high QE at 850-1070 nm

Position-sensitive diodes (PSDs)

Position-sensitive diodes monitor relative changes in the position of a light spot on the detector. These silicon PIN photodiodes utilize the effect of the lateral division of the generated photo-current between the electrical contacts. First Sensor offers one- and two-dimensional PSDs with high sensitivity in the red and infrared spectral range and very high linearity and spatial resolution.



PIN series	Optimized for	Special features
Series 6	700...1000 nm	General purpose, low dark current, fast response
Series 7	700...1000 nm	Low capacitance, full depletable design available

PSD: Position-sensitive diodes with high resolution

These components utilize the effect of the lateral division of the generated photocurrent. The term „position sensitive detector“ (PSD) refers to a component that is based on silicon PIN diode technology and is used to measure the position of the integral focus of an incoming light signal. A light spot on the PSD, for instance, is converted into a continuous electrical signal corresponding to the focal position of this spot. The position of a direction is derived from the relationship between two output currents

Order #	Chip	Package	Dimension	Active area Size (mm) / Area (mm²)	Rise time (ns) M = 100,20 V, 50 Ω	Inter-electrode resistance
500588	OD3.5-6	SO8	single	3.5×1 / 3.5	200	50 ± 20
501278	OD6-6	SO16	single	6×1 / 6	200	85 ± 20
501115	OD6-6	SMD	single	6×1 / 6	200	85 ± 20
500062	DL16-7	CERpin	dual axis	4×4 / 16	500	10
500162	DL16-7	CERsmd	dual axis	4×4 / 16	500	10
501020	DL16-7	LCC10G	dual axis	4×4 / 16	500	10
500054	DL100-7	CERpin	dual axis	10×10 / 100	4000	12
500056	DL100-7	CERsmd	dual axis	10×10 / 100	4000	12
500952	DL100-7	LCC10	dual axis	10×10 / 100	4000	12
500066	DL400-7	CERpin	dual axis	20×20 / 400	4000	12
500068	DL400-7	CERsmd	dual axis	20×20 / 400	4000	12

Applications:
Distance measurement
Optoelectronic displacement transducer
Proximity sensor
Laser alignment
Photometry
Pulsed light detection

Optical sensors

Silicon photomultipliers (SiPMs)

Silicon photomultipliers from First Sensor enable the detection of ultra-low light levels down to single photons. The detectors are optimized for near ultraviolet (NUV) or red, green and blue light with peak sensitivities at 420 nm or 550 nm. Compared to conventional photomultiplier tubes, our SiPMs offer significant advantages such as low operating voltage, excellent temperature stability, immunity to magnetic fields and a much smaller size for easy system integration.

SiPM-NUV: near ultraviolet (NUV) SiPMs

Order #	Package	Active area (mm)	Pixel size (µm)	Pixel	Fill factor	Dark count rate (kHz/mm²)	Photon detection efficiency (%)	Gain
50162801	SMD	1x1	40x40	625	60	<50 @ 2 V OV <100 @ 6 V OV	43	3.6x106
50162802	SMD	Ø 1.2	40x40	673	60	<50 @ 2 V OV <100 @ 6 V OV	43	3.6x106
50162803	SMD	3x3	40x40	5520	60	<50 @ 2 V OV <100 @ 6 V OV	43	3.6x106
50162804	SMD	4x4	40x40	9340	60	<50 @ 2 V OV <100 @ 6 V OV	43	3.6x106

SiPM-RGB: red, green, blue (RGB) SiPMs

Order #	Package	Active area (mm)	Pixel size (µm)	Pixel	Fill factor	Dark count rate (kHz/mm²)	Photon detection efficiency (%)	Gain
50162901	SMD	1x1	40x40	625	60	<100 @ 2 V OV <200 @ 4 V OV	32.5	2.7x106
50162902	SMD	Ø 1.2	40x40	673	60	<100 @ 2 V OV <200 @ 4 V OV	32.5	2.7x106
50162903	SMD	3x3	40x40	5520	60	<100 @ 2 V OV <200 @ 4 V OV	32.5	2.7x106
50162904	SMD	4x4	40x40	9340	60	<100 @ 2 V OV <200 @ 4 V OV	32.5	2.7x106

Applications:
High energy physics
Analytical instruments
Fluorescence detection
Flow cytometry
Radiation detectors

Optoelectronic modules

Our development modules connect the optical sensor with the amplification and electronics required for signal processing and optional with an ultra-stable voltage supply. This allows the sensor to be tested under laboratory conditions and simplifies the integration into your application.

Hybrids

First Sensor offers compact integration of photodiodes and amplifiers. The amplifier is matched to the specific features of the detector. Contact us to find your specific sensor solution.

Series 8: optimized for high cut-off frequencies – 650-850 nm

Order #	Chip	Package	Transimpedance [Ohm]	Bandwidth [MHz]
50162901	AD230-8	TO5	2750	2000
50162902	AD230-8	TO52	2750	2000
50162903	AD500-8	TO5	2750	1000
50162904	AD500-8	TO52	2750	1300

Series 9: with enhanced NIR sensitivity – 900 nm

Order #	Chip	Package	Transimpedance [Ohm]	Bandwidth [MHz]
501403	AD500-9-8015	TO52	2750	500
500756	AD230-9	TO5	2750	600
500490	AD500-9	TO5	2750	500

Series 10: with enhanced NIR sensitivity – 1064 nm

Order #	Chip	Package	Transimpedance [Ohm]	Bandwidth [MHz]
501387	AD800-10	TO8S	10 k	65

Optoelectronic modules

Development modules

First Sensor manufactures APD modules and development boards as well as modules for quadrant photodiodes, position- and wavelength-sensitive photodiodes. They enable test runs in the research lab and easy integration into your system.

Evaluation modules: fast test runs, easy integration

Order #	Chip	Type	Package
50156801	16AA0.4-9	APD array	PCBA
501101	QP45-Q	Quadrant PD	HVSD
500741	QP50-6	Quadrant PD	SD2
500964	QP50-6	Quadrant PD	SD2-DIAG
501102	QP50-6 (18 µm)	Quadrant PD	SD2
501110	QP50-6 (18 µm)	Quadrant PD	SD2-DIAG
501104	QP154-Q	Quadrant PD	HVSD
500788	DL16-7	PSD	PCBA3
500744	DL100-7	PSD	PCBA3
500819	DL400-7	PSD	PCBA
500008	WS7.56	Wavelength sensitive PD	2750
501495	X100-7 with scintillator	Gamma pulse counter	Shielded module

Complete evaluation kits: including power supplies

Order #	Chip	Type
50146502	25AA0.04-9	125 MHz LIDAR-APD-array-eval-kit
501476	64AA0.04-9	125 MHz LIDAR-APD-array-eval-kit
50159502	AD1100-8 (other chips available)	USB-Modul-APD-array-eval-kit
501678, 501679	SiPM	SiPM Modul

High voltage sources

High voltage sources from First Sensor are optimized for use with PIN photodiodes and APDs and feature minimal voltage noise and compact designs.

High voltage sources: up to 500 V

Order #	Max. Voltage [V]	Ripple [mVpp]	Descripition	Features	Footprint [mm]
501385	-500	7.5	High performance HV source	Ultra low ripple	45x29
501381	+500	7.5	High performance HV source	Ultra low ripple	45x29
50138201	+200	7.5	High performance HV source	Ultra low ripple	51x32
501383	+200	<10	Compact HV source	Small footprint	35x20
501384	+600	<10	PIN-Photodiode HV sourve	Very small footprint	23x23

HDR CMOS cameras

Our rugged and compact cameras withstand the toughest conditions: cold, heat or permanent vibrations to name only a few. At First Sensor the complete assembly process is under one roof – from the processing of the sensor chip to the finishing of the camera system. At the same time we save you unnecessary development effort during the integration into your systems due to our modular camera design with different interfaces and data formats. All cameras can be adapted quickly and flexibly to your specific requirements.

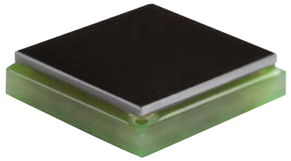
Blue Eagle: digital HDR CMOS cameras

With their extremely large dynamic ranges >120 dB the digital megapixel cameras are ideal for high brightness differences and low light conditions. The cameras offer a wide range of digital data interfaces for easy and flexible integration into automotive on-board networks and driver assistance systems. In addition, the rugged housings protect the cameras against the ingress of water and dust.

Parameter	Features
High dynamic range (HDR)	120 dB
Resolution	1.2 / 1.3 / 2 Megapixel
Input voltage	PoE, Clamp15
Current consumption	>150 mA
Data interface	Ethernet (2-wire & 4-wire), Quiet-wire optional, Power over Data Line optional, LVDS
Diagnostic function	ASIL support
Temperature range	-40 ... 85 °C

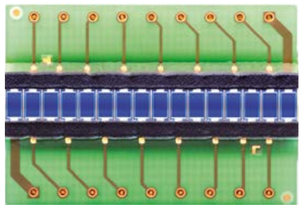
Detectors for ionizing radiation

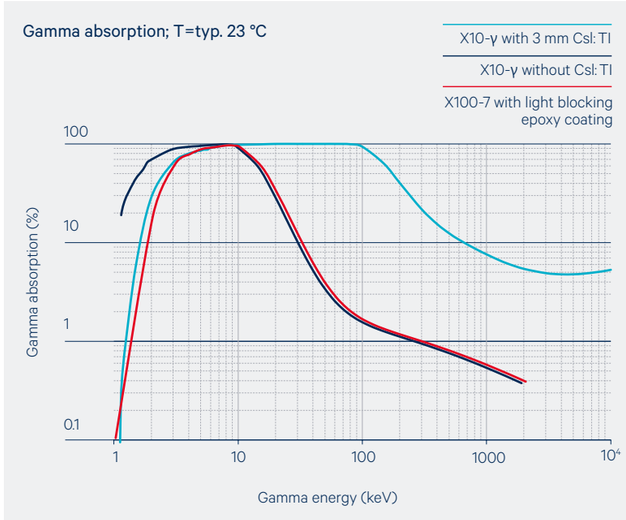
Alpha, beta, gamma, and X-ray radiation can be detected with silicon PIN photodiodes either directly via the absorption in the crystal lattice or indirectly via the measurement of the luminescence radiation of a scintillation crystal. First Sensor develops and manufactures customized photodiodes, detector arrays, and complete systems adapted to your specific requirements.



Radiation sensors with or without scintillator

The Series X from First Sensor features optimized silicon PIN photodiodes, which form wide, fully depleted space-charge regions even at low reverse voltages in order to guarantee the maximum absorption of radiation. For high-energy radiation we offer detectors with a CsI:Tl scintillation crystal. Scintillators convert the ionizing radiation into visible light, which is then measured by highly sensitive photodiodes. Our flat surface mount devices can be assembled to create larger custom detector arrays with very high fitting accuracy.





Applications:
Radiation detectors
Container scanners
Baggage scanners
Scintillator luminescence detection
Photometry
Dosimeter
X-ray fluorescence spectrometers

Series X: modular, sensitive / detectors for ionizing radiation

Order #	Chip	Package	Active area Size (mm) / Area (mm²)	Dark current (nA)	Capacitance (pF)	Gamma-energy (KeV)	Scintillator CsI (Tl)	window
50190301	X5-γ	TO8S	Ø 2.52 / 5	0.01	2.5	>1	no	Ø 6 mm
501559	X7-F	CSP	2.8 x 2.8 / 6.2	0.015	12	-	no	-
50190401	X10-γ	TO8Siγ	Ø 3.75 / 10	0.02	4.5	>1	no	Ø 6 mm
50190001	X10-γ	TO8S Sc	Ø 3.75 / 10	0.02	4.5	2...>1000	yes	Ø 6 mm
501907	X10-6	TO39	Ø 3.57 / 10	0.5	18	>5	no	epoxy dome
501401	X100-7	LCC10	10 x 10 / 100	3	80	>5	no	black epoxy
501400	X100-7	CerPin	10 x 10 / 100	3	80	>5	no	black epoxy
50147702	X100-7	CerPin	10 x 10 / 100	5	80	5„>1000	4 mm	white coating
50147701	X100-7	CerPin	10 x 10 / 100	5	80	5„>1000	8 mm	white coating

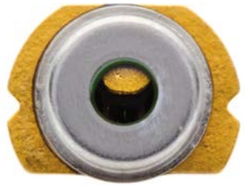
Photodiode arrays: modular, sensitive

Our linear PIN photodiode arrays are optimized for CsI:Tl scintillator luminescence detection and designed for linear multi-device assembly.

Order #	Chip	Package	Elements	Pitch (mm)	Active area Size (mm) / Area (mm²)	Dark current at10 mV (pA)	Capacitance at 0 V (pF)	Scintillator
50146101	16XA1.9-B	DIL18 full	16	1.275	0.9 x 2.15 / 1.94	5	250	optional
50146102	16XA1.9-B	DIL18 slim	16	1.275	0.9 x 2.15 / 1.94	5	250	optional
50146201	16XA2.6-A	DIL18 full	16	1.575	1.2 x 2.15 / 2.58	5	135	optional
50146202	16XA2.6-A	DIL18 slim	16	1.575	1.2 x 2.15 / 2.58	5	135	optional
50146301	16XA5.2-A	DIL18 full	16	2.525	2.15 x 2.4 / 5.16	7.5	240	optional
50146302	16XA5.2-A	DIL18 slim	16	2.525	2.15 x 2.4 / 5.16	7.5	240	optional

Emitters

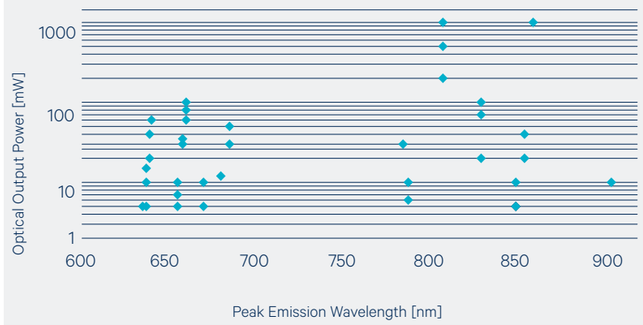
First Sensor provides you with the ideal emitter for their range of optical sensors. We offer laser diodes for the visible and infrared wavelength range. Further, optimized light-emitting diodes (LEDs) are available for high volume applications.



Red laser diodes and IR laser diodes

Laser diodes are available in the wavelength range from 635 nm to 905 nm. The large selection covers lasers with up to 100 mW single-mode CW operation as well as high-power multi-mode lasers.

Overview of available output powers and wavelengths; T=typ. 23 °C



Red laser diodes: single-mode, multi-mode

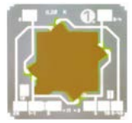
Order #	Typ #	Package	Peak WL λp at Iop (nm)	Optical output power pop typ. at Iop (mW)	Operating current Iop typ. (mA)	Threshold current Ith typ. (mA)	Top. max. (°C)
516301	LD63D4S-A/-B/-C	TO-18	637	5	32	24	40
516302	LD63D5S-A/-B/-C	TO-18	635	5	27	30	50
516303	LD63F5S-A/-B/-C	TO-18	637	10	45	35	50
516309	LD63G5S- A/-B/-C-L	TO-18	639	15	50	30	50
516306	LD63-H5S-A/-B/-C	TO-18	639	20	60	30	50
516501	LD65D5S-A/-B/-C	TO-18	655	5	28	21	50
516502	LD65D5S-A/-B/-C-L	TO-18	655	5	23	16	50
516503	LD65D6S-A/-B/-C	TO-18	655	5	40	30	60
516505	LD65D7S-A/-B/-C	TO-18	655	5	40	30	70
516506	LD65D7S-A/-B/-C-L	TO-18	655	5	27	20	70
516507	LD65E7S-A/-B /-C-H	TO-18	655	7	23	16	70
516508	LD65F5S-A/-B/-C	TO-18	655	10	36	20	50
516509	LD65F6S-A/-B/-C	TO-18	655	10	60	40	60
516510	LD65F7S-A/-B/-C	TO-18	655	10	60	40	70
516511	LD65I7S-A/-B/-C	TO-18	658	30	65	35	70
516512	LD65I7S-A/-B /-C-H	TO-18	658	35	75	35	70
516601	LD65J7S-A/-B/-C	TO-18	660	60	90	45	75
516701	LD67D6S-A/-B/-C	TO-18	670	5	50	40	60
516702	LD67D7S-A/-B/-C	TO-18	670	5	30	20	70
516703	LD67F6S-A/-B/-C	TO-18	670	10	50	40	60
516704	LD67F7S-A/-B/-C	TO-18	670	10	40	20	70
516801	LD68I6S-A/-B/-C	TO-18	685	30	80	35	60
516802	LD68J6S-A/-B/-C	TO-18	685	50	100	35	60

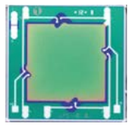
IR laser diodes: single-mode, multi-mode

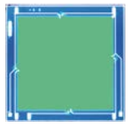
Order #	Typ #	Package	Peak WL λp at Iop (nm)	Optical output power pop typ. at Iop (mW)	Operating current Iop typ. (mA)[/h]	Ith typ. (mA)	Top. max. (°C)
517808	LD78M6S-A/-B/-C	TO-18	780	90	120	30	60
517802	LD78C6S-A/-B/-C-L	TO-18	785	3	20	13	60
517803	LD78E6HG-Q	TO-18	788	6	27	14	60
517804	LD78F6DF-1	TO-18	788	10	25	14	60
517805	LD78F6S-A/-B/-C	TO-18	788	10	22	12	60
517806	LD78I6S-A/-B/-C - L	TO-18	785	25	45	15	60
518002	LD80R4S-A/-B/-C/-D/-E-Z4	TO-18	808	200	250	60	40
518303	LD83O6S-A/-B/-C	TO-18	830	100	220	70	60
518501	LD85D6S-A/-B/-C	TO-18	850	5	20	10	60
518502	LD85F6S-A/-B/-C	TO-18	850	10	25	10	60
518503	LD85H6S-A/-B/-C	TO-18	855	20	55	20	60
518504	LD65F5S-A/-B/-C	TO-18	855	40	75	30	60
519001	LD65F5S-A/-B/-C	TO-18	905	10	35	12	70

MEMS pressure sensor elements and components

Pressure sensor elements from First Sensor utilize the „Sensor Technology for Advanced Resistors“ (STARe). This technology is based on the development of suitable materials, layouts and electrical shielding and enables pressure measurement with highest accuracy and stability.







Pressure sensor elements: highest accuracy and stability

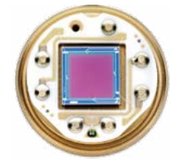
Our piezoresistive silicon pressure sensors include product lines for highest precision (High Stability Line) as well as for aggressive media and fluids (Harsh Environmental Line) for absolute, gage and differential pressure from 3 kPa (30 mbar) up to 60 MPa (600 bar).

	Standard Line STARe	Industrial Line STARe
Pressure ranges	1 bar to 30 bar	100 mbar to 600 bar
Pressure type	Absolute, gage, differential	Absolute, gage, differential
Output signal (span)	typ. 70...100 mV	typ. 60...290 mV
Thermal effects		
- Offset	typ. +0.02 %FSS/K	typ. ±0.02 %FSS/K
- Span	typ. -0.19 %FSS/K	typ. -0.19 %FSS/K
- Bridge resistance	typ. +0.31 % /K	typ. +0.26 % /K
Operating temperature range	-40...150 °C	-40...150 °C

	High Stability Line STARe	Harsh Environmental Line
Pressure ranges	30 mbar to 400 bar	2 bar to 16 bar
Pressure type	Absolute, gage, differential	Absolute
Output signal (span)	typ. 80...250 mV	typ. 100 mV
Thermal effects		
- Offset	typ. ±0.01 %FSS/K	typ. ±0.04 %FSS/K
- Span	typ. -0.20 %FSS/K	typ. -0.20 %FSS/K
- Bridge resistance	typ. +0.09 % /K	typ. +0.26 % /K
Operating temperature range	-40...125 (150) °C	-40...125 (150) °C

Pressure sensor components: highest accuracy and stability

K-Series STARe pressure sensor components from First Sensor are pressure sensor elements of the High Stability Line STARe mounted on a TO-8 header whose coefficient of thermal expansion is adapted to the sensor element. Further, the devices include a high-precision PTC temperature sensor and ceramic components to reduce the dead volume. This construction enables precision measurements within the 0.04 % accuracy class. The K-Series STARe is supplied with a plastic housing for transport protection and pressure measurements up to 10 bar.



	K-Serie-STARe A/G	K-Serie-STARe D
Pressure ranges	60 mbar to 400 bar	30 mbar to 10 bar
Pressure type	Absolute, gage	Differential
Output signal (span)	typ. 100...250 mV	typ. 80...100 mV
Thermal effects		
- Offset	typ. ±0.01 %FSS/K	typ. ±0.01 %FSS/K
- Span	typ. -0.20 %FSS/K	typ. -0.20 %FSS/K
- Bridge resistance	typ. +0.09 % /K	typ. +0.09 % /K
Operating temperature range	-40...125 °C	-40...125 °C

Pressure sensors and pressure transmitters

First Sensor develops and manufactures a large selection of highly accurate and reliable pressure sensors and pressure transmitters for air, gas and liquids. The sensors either provide basic mV signals or fully signal conditioned analog or digital outputs. Our rugged industrial pressure transmitters use ceramic or stainless steel pressure sensor elements to achieve high media compatibility for corrosive liquids and gases.

Uncompensated pressure sensors:
piezoresistive basic pressure sensors

Our cost-effective piezoresistive pressure sensors for air and gases offer pressure ranges up to 10 bar. The uncalibrated and uncompensated basic sensors feature analog mV output signals and almost unlimited resolution. They offer very small housings with pressure ports for tubing or manifold connection and custom pressure ranges.

	HDU	HMU
Pressure range	100 mbar to 5 bar	100 mbar to 10 bar
Pressure type	Absolute, gage, differential	Absolute, gage, differential
Output signal (span)	typ. 60...100 mV	typ. 50...100 mV
Thermal effects		
- Offset	typ. ±0.02 %FSS/°C	typ. ±0.02 %FSS/°C
- Span	typ. -0.2 %FSS/°C	typ. -0.19 %FSS/°C
- Bridge resistance	typ. 0.26 %/°C	typ. 0.26 %/°C
Operating temperature range	-40...85 °C	-40...85 °C

Applications:
Instrumentation
HVAC
Pneumatic and environmental controls
Industrial measurement and control
Industrial machines
Analytical instruments

Temperature compensated pressure sensors:
calibrated and temperature compensated

High-precision miniature piezoresistive pressure sensors for air and gases from First Sensor feature full scale pressure ranges from 5 mbar. The sensors provide calibrated and temperature compensated analog mV output signals and almost unlimited resolution. They are available in many different housing options and with custom pressure ranges.

	HCL	HDO	HRO
Pressure range	5 to 75 mbar	10 mbar to 5 bar	10 mbar to 10 bar
Pressure type	Gage, differential	Absolute, gage, differential	Gage, differential
Output signal (span)	typ. 10...20 mV	typ. 20...90 mV	typ. 13...100 mV
Accuracy (non-linearity, hysteresis)	typ. ±0.05 %FSO	typ. ±0.1 %FSO (P-Grade) typ. ±0.2 %FSO (H-Grade)	typ. ±0.25 %FSS
Temperature range			
- compensated	0...50/70 °C	0...50 °C	0...50/70 °C
- operating	-25...85 °C	-40...85 °C	-25...85 °C

Pressure sensors with integrated signal conditioning:
amplified output signal

Digital piezoresistive miniature pressure sensors with amplified output signals for air and gases from First Sensor feature full scale pressure ranges from 2.5 mbar, a broad range of housing options and custom pressure ranges. High-resolution digital signal conditioning provides for a very high level of overall accuracy within large operating temperature ranges.

	HCLA	HCE	HDI
Pressure range	2.5 to 75 mbar	10 mbar to 5 bar, barometric pressure ranges	10 mbar to 5 bar, barometric pressure ranges
Pressure type	Gage, differential	Absolute, gage, differential	Absolute, gage, differential
Output signal	Analog and I²C-Bus	Analog and SPI-Bus	Analog and I²C-Bus
Accuracy			
- Non-linearity, hysteresis	typ. ±0.05 %FSS		
- Total accuracy (0...85 °C)		max. ±0.5 %FSS	max. ±0.5 %FSS
Operating temperature range	-25...85 °C	-25...85 °C	-20...85 °C

Pressure sensors and pressure transmitters

Pressure sensors based on flow measurement: ultra-low pressure

Our ultra-low differential pressure sensors from 0.25 mbar (25 Pa) are based on thermal mass flow measurement. The extremely low air flow through a micro-flow channel integrated within the sensor chip ensures high immunity to dust contamination and condensation. The sensors feature high sensitivity and offset stability.

	LDE	LME	LMI
Pressure range	25 to 500 Pa	25 to 500 Pa	25 to 500 Pa
Pressure type	Gage, differential	Gage, differential	Gage, differential
Output signal	Analog and SPI bus	Analog and SPI bus	I²C bus
Offset stability	max. 0.1 % p.a. (ab 50 Pa)	max. 0.1 % p.a. (ab 50 Pa)	typ. 0.02 % p.a. (ab 50 Pa)
Total accuracy	typ. ±0.5 %FS	typ. ±0.5 %FS	typ. ±0.5 %FS
Temperature range			
- compensated	0...70 °C	0...70 °C	-20...85 °C
- Operating	-20...80 °C	-20...80 °C	-40...85 °C

Pressure sensors with increased media compatibility: amplified output and digital interface

Our miniature piezoresistive pressure sensors with digital signal conditioning provide measurement ranges up to 10 bar and increased media compatibility for gases and liquids. We offer various housing options with a selection of pressure ports and custom pressure ranges.

	HMA	HMI	HME
Pressure range	100 mbar to 10 bar	100 mbar to 10 bar	100 mbar to 10 bar
Pressure type	Gage, differential	Gage, differential	Gage, differential
Output signal	Analog	I²C bus	SPI bus
Accuracy			
- Non-linearity, hysteresis	max. ±0.25 %FSS	max. ±0.25 %FSS	max. ±0.25 %FSS
- Total accuracy (-20...85 °C)	max. ±1.5 %FSS	max. ±1.5 %FSS	max. ±1.5 %FSS
Operating temperature range	-20...85 °C	-20...85 °C	-20...85 °C

Pressure sensors for corrosive liquids and gases: fully welded, stainless steel

Our fully welded, media isolated stainless steel pressure sensors allow for high media compatibility with corrosive liquids and gases. These sensors stand out through their excellent price/performance ratio as well as very good stability and repeatability.

	SSO	SSI
Pressure range	200 mbar to 35 bar	200 mbar to 35 bar
Pressure type	Absolute, gage	Absolute, gage
Output signal	typ. 45...130 mV (span)	Analog and I²C bus
Accuracy		
- Non-linearity	typ. ±0.1 %FSO	
- Total accuracy (-20...85 °C)		max. ±1.5 %FSS
Temperature range		
- compensated	0...50 °C	-20...85 °C
- operating	-40...125 °C	-40...120 °C

Low pressure transmitters: for air and gases

Low pressure transmitters for air and gases from First Sensor offer full scale pressure ranges from 1 mbar. Options include a broad range of pressure and electrical connections as well as fast and flexible customization to specific requirements.

	CTE7000	BTE5000
Pressure range	10 mbar to 5 bar	1 mbar to 10 bar
Pressure type	Absolute, gage	Gage, differential
Output signal	0...5 V, 0...10 V, 0,5...4,5 V, 1...6 V, 4...20 mA	1...6 V, 4...20 mA
Accuracy (non-linearity, hysteresis)	typ. ±0.2 %FSO	typ. ±0.1/0.2 %FSO
Temperature range		
- compensated	0...50 °C	0...50/70 °C
- operating	-25...85 °C	-25...85 °C

Pressure transmitters for corrosive liquids and gasese: high media compatibility

Our pressure transmitters for corrosive liquids and gases use ceramic or stainless steel pressure sensor elements to ensure high media compatibility. The transmitters are available with a choice of different pressure and electrical connections and as custom versions.

	CTE8000	CTE9000	KTE6000
Pressure range	250 mbar to 100 bar	100 mbar to 35 bar	250 mbar to 400 bar
Pressure type	Absolute, gage	Absolute, gage	Absolute, gage
Output signal	0...5 V, 0...10 V, 0,5...4,5 V, 1...6 V, 4...20 mA	0...5 V, 0...10 V, 0,5...4,5 V, 1...6 V, 4...20 mA	0...5 V, 0...10 V, 0,5...4,5 V, 1...6 V, 4...20 mA
Accuracy (non-linearity, hysteresis)	typ. ±0.1 %FSO (incl. repeatability)	typ. ±0.1 %FSO	typ. ±0.1 %FSO (incl. repeatability)
Temperature range			
- compensated	0...70 °C	0...50 °C	0...70 °C
- operating	-25...85 °C	-40...85 °C	-25...85 °C

OEM pressure sensors

First Sensor develops and manufactures innovative and reliable pressure sensors for OEM applications that are adapted to your specific requirements with the help of our vast application experience. Due to our in-house production of all main sensor components we are able to ensure long product availability for your serial production.

Custom OEM pressure sensors

We design, develop and manufacture compact pressure sensors for integration into high-volume OEM applications. Our sensors are available in different pressure ranges from vacuum to high pressure and with customer-specific electrical connectors and pressure ports. Further, we offer a range of analog and digital interfaces such as ratiometric voltage output, SENT, LIN, PWM and I²C.

Parameter	Special features
Pressure range	up to 3000 bar
Pressure type	Absolute, gage
Output signal	Ratiometric, SENT, LIN, PWM, I²C
Temperature range	-40...150 °C
Protection class	IP6K9K

Flow sensors

Our thermal mass flow sensors record even smallest flows fast and with high precision. Within a modular technology platform First Sensor provides complete packaging technologies so as to realize complex custom specific solutions from individual chip elements. Further, our differential pressure sensors detect ultra-low pressure drops in volumetric flow measurement applications.

Thermal mass flow sensors: fast, low power consumption

Our mass flow sensors for air and gases utilize a highly sensitive thermal measuring principle to detect even smallest flows. The sensors are based on highly stable MEMS silicon chip technology and feature fast response times, low power consumption and bidirectional sensing capabilities.

	WBI	WBA	WTA
Flow ranges	200 ml/min to 1 l/min	200 ml/min to 1 l/min	2 to 50 l/min
Output signal	I²C bus	1...5 V	0.5...4.5 V
Accuracy (hysteresis, repeatability)	max. ±0.25 % of reading	max. ±0.25 % of reading	typ. ±0.25 % of reading
Temperature range			
- compensated	0...50 °C	-25...85 °C	0...50 °C
- operating	-25...80 °C	-25...85 °C	-25...85 °C

Differential pressure sensors: for volumetric flow measurement

Differential pressure sensors and rugged differential pressure transmitters for volumetric flow measurement from First Sensor detect the pressure drop across a flow element. Our flow-based ultra-low differential pressure sensors from 0.25 mbar (25 Pa) feature high sensitivity and offset stability as well as high immunity to dust contamination and condensation.

	LDE/LME/LMI	HCLA	BTE5000
Pressure range	25 to 500 Pa	2,5 to 75 mbar	1 mbar to 10 bar
Pressure type	Gage, differential	Gage, differential	Gage, differential
Output signal	Analog and SPI bus, I²C bus	Analog and I²C bus	1...6 V, 4...20 mA
Housing	SMT, SIL	SMT, SIL	Transmitter (aluminum)

Applications:
HVAC
Leak detection
Analytical instruments
Laboratory devices
Fuel cells
Gas meters

Level sensors

Fluid level control sounds quite easy but can turn into a demanding sensor application problem if movement, foaming, or media and container issues come into play. To reliably monitor the liquid level in tanks or containers, First Sensor offers different sensor technologies. Depending on the applicati-on, they can register the level continuously or using limit values.

Hydrostatic liquid level sensors: high media compatibility

Submersible hydrostatic liquid level sensors with amplified output signals from First Sensor use ceramic or stainless steel pressure sensor elements to achieve high media compatibilities. For these sensors we offer fast and flexible modifications based on your specific requirements.

	CTE8000...CS	CTE9000...CS	KTE8000...CS
Pressure/level ranges	from 250 mbar/from 2.5 mH_2O	from 100 mbar/from 1 mH_2O	from 250 mbar/from 2.5 mH_2O
Pressure type	Gage	Gage	Gage
Output signal	0...10 V, 4...20 mA	0...10 V, 4...20 mA	0...10 V, 4...20 mA
Accuracy (non-linearity, hysteresis)	typ. ±0.1 %FSO (incl. repeatability)	typ. ±0.1 %FSO	typ. ±0.1 %FSO (incl. repeatability)
Temperature range - compensated	0...70 °C	0...50 °C	0...70 °C
- operating	-10...70 °C	-10...70 °C	-10...70 °C

Optical liquid level switches: small and cost-effective

Optical liquid level switches from First Sensor use solid state technology with no moving parts and reliably distinguish between liquid and gas. The sensors are suitable for simple, space-saving installation in tanks, containers and pipes.

	OLP/OLT	OLM
Output	100 mA, 1 A	10 mA, 800 mA
Operating temperature range	-25...80 °C, -40...125 °C	-25...80 °C, -40...125 °C

MEMS inertial sensors

First Sensor features a highly innovative technology platform for manufacturing high-precision inertial sensors for geoengineering, condition monitoring or navigation applications. The MEMS sensors allow for flexible customization to fit your individual application requirements.

Inclinometers and accelerometers

Our capacitive inclinometers and accelerometers are based on single crystal silicon sensor elements and utilize state-of-the-art micromachining technology to achieve large signal-to-noi-se ratios and excellent stability over temperature. Therefore, they are able to detect extremely small changes in inclination or acceleration. Due to high aspect ratio microstructures (HARMS) the sensors feature ultra-low cross axis sensitivities. Further, the patented highly flexible AIM (Air gap Insulated Microstructures) technology minimizes parasitic capacitances.

	Inclinometer	
Parameter	SI-11.S1.C-30	Unit
Measurement range	±30	°
Resolution at 10 Hz	< 0.0015	°
Scale factor (repeatability)	±35	ppm
Scale factor (temperature coefficient)	±50	ppm/K
Bias (repeatability)	±0.0030	°
Bias (temperature coefficient)	±0.0025	°/K
Noise density	< 0.0004	°/√Hz
Measuring frequency	400	Hz
Digital interface	SPI	
Operating temperature	-40 ... 85	°C

	Accelerometer			
Parameter	SA-12.S1.C-3	SA-13.S1.C-8	SA-14.S1.C-15	Unit
Measurement range	±3	±8	±15	g
Resolution at 10 Hz	< 40	< 65	< 95	µg
Scale factor (repeatability)	±35	±35	±35	ppm
Scale factor (temperature coefficient)	±50	±50	±50	ppm/K
Bias (repeatability)	±115	±260	±470	µg
Bias (temperature coefficient)	±65	±105	±175	µg/K
Noise density	< 12	< 20	< 30	µg/√Hz
Measuring frequency	400	400	400	Hz
Digital interface	SPI	SPI	SPI	
Operating temperature	-40...85	-40...85	-40...85	°C

Applications:
Geoengineering,
Condition monitoring
Navigation
Robotics
Alignment and leveling
Security systems

Development and production services

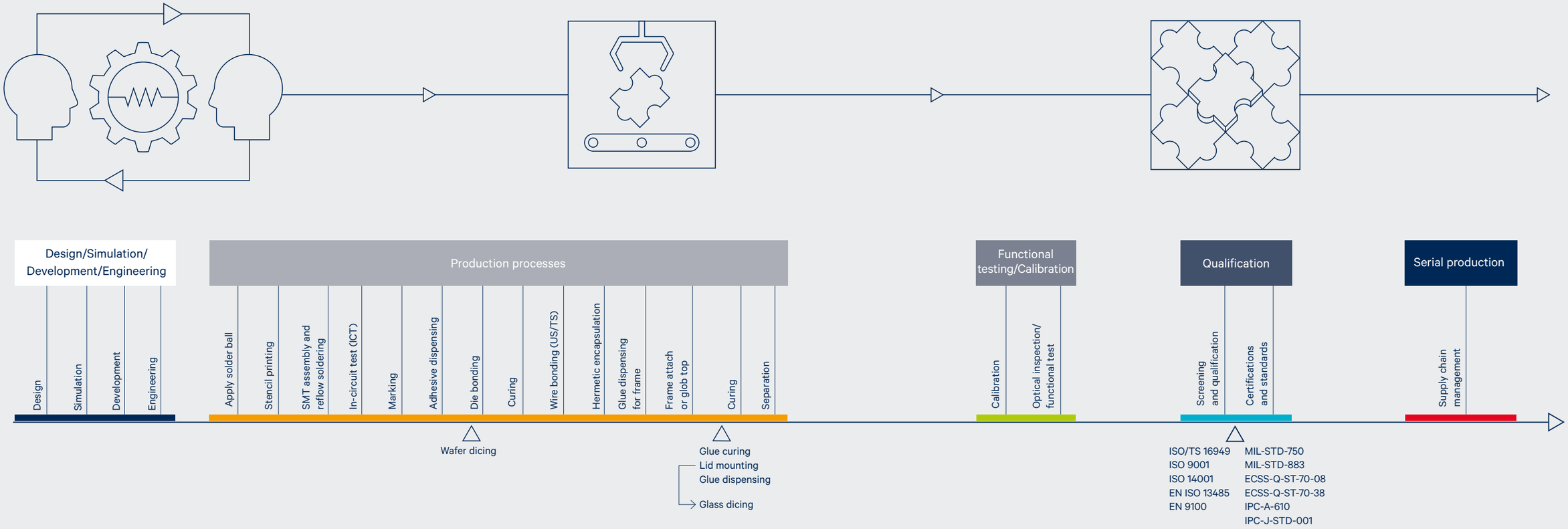
As a manufacturer of sophisticated systems, are you always facing new challenges because of global competition, increasing process requirements and new customer requests? Are you looking for ways to distinguish yourself and your products? You can do this with even more precise and faster measurements, more efficient and cost-reducing integration, application-specific combinations of measurement procedures, special form factors of sensor systems and/or greater reliability.

Standard sensors are often no longer enough to distinguish yourself from the competition. Sustainable application, quality and cost advantages can only be achieved and guaranteed with customized sensor systems. The development of application-specific sensor systems therefore presents you with a make-or-buy decision. Even if the sensor technology is an extremely important system component of your targeted solution, you are often unwilling or unable to allocate the development resources and expertise required for such developments.

The reasons for this are manifold:

- Capacity bottlenecks: internal development teams are tied up in other projects.
- Specific expertise: you do not have the metrological know-how to develop and produce specific sensor systems reliably and efficiently or to integrate new sensor technology.
- Outsourcing strategy: sensor technology is part of your own applications but is not considered a core competence.
- Risk and cost management: you want to speed up development projects significantly, limit cost and technology risks or achieve a predictable ROI via external development projects at fixed prices.

First Sensor is your first port of call if you are looking for a competent, reliable partner with many years' experience for the development and production of high-performance, customer-specific sensor systems.



Strategic partner for development and production of customized products

As a specialist in the development and production of sensor systems, we have been enabling long-term differentiation from the competition for many years. We provide all the expertise, technology and capacity this requires:

- Complete development services ranging from the solution concept and initial proof-of-concept to prototypes and serial production maturity; from hardware to software and integration; microsystems technology from the ASIC and the module to the end product.
- Design and implementation of technologies that enable many sensor functions and applications in the first place.
- State-of-the-art production capacity for a broad range of volumes – from rapid prototype production to order-based, cost-efficient serial production of millions of units.
- Support for development by metrology specialists from various disciplines and the use of application-specific metrological test stations and calibration services.
- Development, validation, qualification and reliability certification, production and testing according to industry-specific quality standards and certifications (e.g. EN ISO 13485 for medical devices and ISO/TS 16949 for the automotive industry).

Tried-and-tested approach for maximum efficiency and minimum risks

We offer you not only metrological know-how, but also seasoned project management that allows highly efficient as well as low-risk developments.

1 State-of-the-art production in our own clean rooms

First Sensor worldwide

First Sensor is headquartered in Berlin and represented at six locations in Germany and also operates sales and production sites in the USA, Canada, China, UK, France, Denmark, Sweden and the Netherlands as well as a global network of partners.

Australia
- Sydney

Belgium
- Zaventem

China
- Hangzhou
- Shanghai

Denmark
- Copenhagen

Germany
- Berlin-Oberschöneweide
- Berlin-Weißensee
- Dresden-Klotzsche
- Dresden-Albertstadt
- Munich (Puchheim)
- Ulm (Oberdischingen)

Spain
- Madrid

France
- Paris
- Lisses

United Kingdom
- Shepshed

India
- Faridabad

Israel
- Rishon Le-Zion
- Tel Aviv

Italy
- Aicurzio
- Rome

Japan
- Tokio

Canada
- Montreal

Korea
- Cheonan-si

Netherlands
- Eindhoven
- Dwingeloo
- Valkenswaard

Sweden
- Kungens Kurva
- Uppsala

USA
- Lexington
- Mansfield
- Westlake Village

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